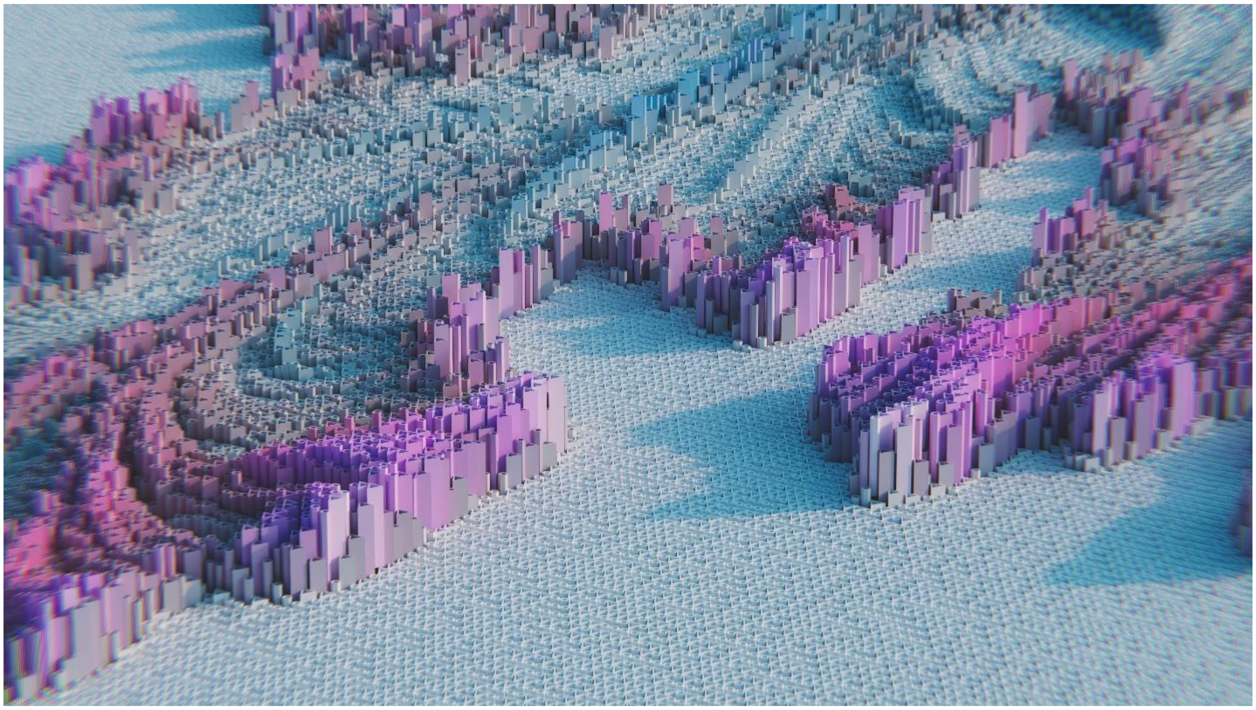

Leveraging Synthetic Data in Healthcare: A Path to Market Emulation Models

Introduction:

In the ever-evolving landscape of the biopharmaceutical business, data-driven decision-making has become standard practice. Tudor Health is creating a leadership position in the provision of patient-level data by harnessing the power of Synthetic Data (SD). This innovative approach promises to revolutionize how we use data in biopharma, particularly in the creation of Market Emulation Models (MEMs). In this article, we will delve into Tudor Health's vision, strategy, and goals, and explore the potential of SD and MEMs in transforming analytics and insights within biopharma commercial operations.[i]

1. Vision, Strategy, and Goals:

Tudor Health's vision is crystal clear: to be a frontrunner in delivering longitudinal patient-level data. The cornerstone of this strategy lies in the adoption of Synthetic Data, a cutting-edge technology that holds the potential to redefine data utilization in the healthcare sector.

1.1 Synthetic Data – An evolutionary step, not a revolution:

AI-generated Synthetic Data may seem like the latest buzzword, but it represents a significant shift in biopharma commercial data analytics. It's not unusual for evolutionary methodologies to face initial scepticism before gaining widespread acceptance. Let's draw a parallel to historical trends:

- Analogues in forecasting: In the past, the industry relied on existing product data to forecast the performance of new products. This practice evolved into a sophisticated modelling technique, demonstrating the potential for unconventional approaches.
- "Black box" models (neural networks, etc.): Initially met with scepticism, black box models, which are essentially early forms of machine learning, are now embraced, so long as they bear the "AI" label.
- Hierarchical Bayesian analysis: This method, akin to synthetic data, creates inferred curves from measured values, ultimately becoming an industry standard. It illustrates that innovation often lies in revisiting and refining existing techniques.

The common thread is that evolutionary breakthroughs often emerge from unconventional methodologies that deliver tangible results. Senior management in life science companies prioritizes repeatability over absolute transparency when assessing the value of data solutions.

1.2 Tudor Health's Novel Position:

Tudor Health is uniquely poised to provide syndicated data products to life science commercial departments. They possess a proprietary source of high-quality longitudinal patient data, complemented by advanced analytics capabilities essential for constructing high-fidelity synthetic data models. This combination places Tudor Health in an ideal position to deliver innovative solutions to the healthcare market, most particularly Market Emulation Models (MEMs).

2. Market Emulation Models (MEMs):

But what exactly are Market Emulation Models, and how do they tie into Tudor Health's synthetic data strategy?

2.1 The Essence of MEMs:

In most research endeavours, data are collected from a sample that represents a subset of the total population. Tudor Health, however, takes this a step further with

Market Emulation Models (MEMs). MEMs transform detailed individual patient data into market emulators that have data on every individual within the entire patient population. Even though the bulk of the data have been generated synthetically, the accuracy, consistency and granularity of the data create a reliable emulation of the real patients.

When meticulously developed, MEMs can serve a plethora of purposes, from forecasting and brand tracking to targeting, pricing, and access support. Regular updates to MEMs ensure that they offer a dynamic and comprehensive view of a disease space, akin to having access to detailed registry data, only without the restrictions on usage that come with registry data.

Notably, while non-commercial departments of life science companies have access to registries and similar data for non-commercial purposes, MEMs are tailored explicitly for commercial use.

2.2 Building MEMs:

Constructing SD and MEMs is no simple feat and requires high-quality data linked to advanced computer modelling. The process often involves integrating data from various sources to create a functional MEM. Additionally, MEMs incorporate commercial response models related to pricing, access, and promotion, necessitating additional data integration.

At Tudor Heath we understand the barriers to creating SD and MEMs, and also how to overcome or mitigate these issues:

- Data Privacy and Security: ensuring complete compliance with all standards whilst maintaining data integrity.
- Data Diversity: adjusting models to ensure that inherent biases in the data are removed (often completed in the data capture phase by adjusting samples).
- Data Granularity: capturing accurate, granular data from the outset to ensure that the SD are accurate and reliable.
- Clinical Validity: ensuring that the raw data are clinically accurate results in valid and reliable SD.
- Data Volume and Complexity: using data structures and models that make the SD and MEMs accessible and practical across all applications.
- Bias and Generalization: biases beyond DEU (see above) must also be excluded from data capture and/or modelled out of the SD.

- Realistic Variability: using valid models to ensure that long-tail distributions seen in the real world are accurately reflected in the SD.
- Ethical Considerations: beyond regulations and guidelines, maintaining strong ethical practices creates higher confidence in the SD and MEMs.
- Validation and Evaluation: executing strong validity checks at all stages of the process to ensure the highest possible levels of validity in the final SD – something that is continuously monitored.
- Collaboration and Data Sharing: working with experts in particular use-cases, such as primary market research and forecasting, to improve the practical value of the SD and MEMs.
- Cost and Resources: ensuring and efficient business model that allows differential access to SD and MEMS, ensuring that access is not limited to a few large companies.
- Regulatory Compliance: comprehensive adherence to the highest standards through thorough assessment of all elements of the SD and MEM creation process via independent compliance experts.

MEMs are constructed using a wide array of detailed patient data, including patient profiles, diagnostic profiles, test results, treatment histories, disease progression, and more. The interrelation of these variables ensures that MEMs mirror the characteristics of the total patient population accurately.

3. MEM Use Cases:

Now, let's explore the real-world applications of MEMs and how they can reshape the healthcare landscape.

3.1 Physician Targeting Outside the USA:

In the United States, creating targeted physician lists is feasible due to data availability. However, stringent data privacy laws in non-US markets pose a challenge. Synthetic data can bridge this gap by creating models that generate reliable targeting lists for international markets, a particularly valuable resource in the realm of rare diseases.

These hybrid models mimic prescribing patterns across institutions, enabling differential targeting based on patient profiles, institution types, and more.

3.2 New Product Tracking:

Launching new products, especially in rare diseases, is complicated by the lack of reliable patient data. With high-quality longitudinal patient data, synthetic data models can replicate the behaviour of entire rare disease markets. This capability is being used in the tracking of new products and the associated precise commercial tactical adjustments.

3.3 Forecasting:

MEMs are being leveraged to create multiple future market scenarios based on varying assumptions and forecasting outputs. As data becomes available and assumptions evolve, these scenarios are adjusted to align with real-world conditions, bolstering forecast reliability.

Furthermore, MEMs constructed with hierarchical Bayes are providing more advanced forecasting capabilities, providing a complex yet potentially game-changing approach.

3.4 Market Research:

Synthetic data-enabled MEMs offer a powerful tool for market research. They are being used for challenge/response tests based on research questions and findings, particularly in scenario-based research like choice models. MEMs are also informing sample design and questionnaire design in primary research, creating a comprehensive market simulation.

Conclusion:

Tudor Health's vision in becoming a leading provider of individual-level data through synthetic data and Market Emulation Models represents a bold step toward modernising commercial data utilization in biopharma. As the industry increasingly embraces non-traditional methodologies, the potential for innovation and competitive advantage becomes clear. Synthetic data, in conjunction with MEMs, has the power to improve biopharma commercial decision-making and provide life science companies with a strategic edge in a data-driven world.

On reading this paper, if you realise that your current commercial and insight challenges could be met through the use of SD and MEMs, get in touch with us at Tudor Health and we can discuss an execution that meets your needs.

Equally, if you are still unsure about MEMs, but would like to explore how they might be used in your organisation, contact us to discuss how they can be applied to your commercial goals."

The future of healthcare data is synthetic, and Tudor Health is leading the way.

[i] Synthetic data is increasingly finding valuable applications in the life science industry, offering innovative solutions to address various challenges and opportunities. Here are some key uses of synthetic data in this sector:

1. **Drug Discovery and Development:** Synthetic data can aid in the drug discovery process by generating simulated datasets that mimic real-world patient populations. This enables researchers to test potential drug candidates more efficiently and effectively, reducing the need for extensive and costly clinical trials. Synthetic data can also help in identifying potential biomarkers and predicting drug interactions, streamlining the drug development pipeline.
2. **Clinical Trials Optimization:** Synthetic data can be used to create virtual patient populations that mirror the characteristics of real patients. This allows for the design and optimization of clinical trials, helping researchers determine the most effective trial protocols, patient recruitment strategies, and endpoints. It also aids in assessing the feasibility of trials and estimating their potential success rates.
3. **Privacy-Preserving Research:** In an era of strict data privacy regulations like HIPAA and GDPR, synthetic data offers a way to conduct research and analysis while safeguarding patient privacy. Researchers can use synthetic data to simulate patient records, preserving confidentiality while still allowing for meaningful analysis and insights.
4. **Rare Disease Research:** Synthetic data is particularly beneficial in the study of rare diseases, where limited patient data may hinder research efforts. By generating synthetic datasets that represent rare disease populations, researchers can conduct more comprehensive investigations, leading to better understanding, diagnosis, and treatment options.
5. **Market Analysis and Commercialization:** Life science companies can leverage synthetic data to create Market Emulation Models (MEMs) that simulate disease markets. MEMs enable companies to refine their market strategies, assess the potential impact of new products, and make informed decisions regarding product pricing, targeting, and positioning. This can lead to more successful product launches and better market penetration.
6. **Data Integration and Standardization:** Synthetic data can facilitate the integration and standardization of diverse healthcare data sources. It allows for the creation of unified datasets that combine information from electronic health records (EHRs), medical claims, genomic data, and more. This comprehensive view of patient data enhances research capabilities and supports data-driven decision-making.
7. **Machine Learning Model Development:** Synthetic data serves as a valuable resource for training and testing machine learning models in healthcare. It provides a controlled environment for model development, ensuring that algorithms are optimized before deployment on real patient data. This minimizes risks and enhances the accuracy and reliability of predictive models.
8. **Medical Device Testing:** Synthetic data can be used to simulate the performance of medical devices in various scenarios. This aids in the design and testing of new medical technologies, ensuring their safety and effectiveness before they are introduced into clinical practice.
9. **Education and Training:** Synthetic data is a valuable tool for medical education and training purposes. Medical students and professionals can practice diagnostics, treatment planning, and surgical procedures using realistic patient data without compromising privacy or patient confidentiality.

In summary, synthetic data is a versatile and powerful tool that has the potential to transform various aspects of the life science industry. From drug discovery and clinical trials to market analysis and privacy protection, its applications are expanding the boundaries of research, innovation, and data-driven decision-making in healthcare.

Title image courtesy of Google DeepMind on Unsplash