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# Optimizing Healthcare Operations and Patient Care through AI-Powered Analytics with Power BI and DAX Copilot

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**ABSTRACT:** Power BI is an efficient tool for business intelligence and data visualization and is particularly successful in converting complicated data to actionable information in a health care setting. Power BI's most powerful feature is its ability to connect isolated data sources like operational and electronic health record data for immediate decision making in high-frequency situations. Clinicians can use Power BI to develop individualized treatment methodologies for quality and efficient patient care based on previous hospitalizations and hospital systems. Power BI also automates compliance management to validate regulatory reporting and compliance with regulatory standards, like HIPAA and HL7. Additionally, Power BI has a user-friendly experience and built-in security features which will provide operational transparency and collaboration amongst healthcare staff. Recently, Power BI has integrated DAX Copilot, which automates DAX Queries, and allows for dialoging about data in conversational format. This feature of Power BI minimizes inquiry documentation for physician users and enhances clinical data reliability. DAX Copilot's multi-purpose functionality spans clinical specialties and supports clinical research and health equity work, while reinforcing appropriate AI behavior in relation to health regulations. Overall, the DAX Copilot, in conjunction with Power BI, makes healthcare documentation and analytics better with key factor of providing higher quality care for healthcare providers and creating a reactive, AI-driven healthcare ecosystem.

**KEYWORDS:** Power BI, Data Analysis Expressions (DAX), DAX Copilot, HIPAA, HL7

## I. INTRODUCTION

Power BI Desktop is a free Windows application that allows users to connect to, manipulate and visualize data so they can create dashboards and reports for interactivity. Power BI Desktop's original purpose is to create reports and data models and publish them to the Power BI service, a cloud service. Power BI has many benefits, including good data transformation capabilities, a drag and drop user interface that does not require the user to have a scripting language background, and the ability to integrate with other Microsoft applications. Users can connect to data sources from cloud services, SQL databases, and Excel files, providing the user with a range of options to access data. There is a Query Editor in Power BI that provides convenience in cleaning and transforming data without code. Data modeling is the process of aggregating data from different sources and creating relationships between the datasets.

Power BI Desktop enables users to create interactive visuals like maps, graphs and charts as an effective way to visualize data within the application and allow the user to share this data. The use of DAX is allowed in order to use more advanced calculations and slicing and filtering data to allow for more significant analysis to be done. Other advantages include: free, intuitive design for a less technical user, robust set of data preparation tools, power at-a-glance visuals, good integration with the Microsoft ecosystem, including their use with Azure, and Excel has good integration with Power BI Desktop. More to the point of personal use, when data analysis does not have to be done at an enterprise level, Power BI Desktop enables flexibility of individual use for analysis and for larger use at the enterprise level for analysis which would allow many levels and flexibility of analysis over varying levels of scale. [1]

Power BI has two main functions: the modelling and data processing tools and the fundamental applications. The data processing tools are Power Query for data cleansing and transformation, and Power Pivot for calculations and relationships between tables. Power BI Desktop is a free Windows desktop application that enables users to create interactive reports and connect to a variety of data sources. The Power BI Service is used for sharing and collaborating on dashboards and reports in the cloud, and Power BI Mobile provides access to reports on iOS and Android devices. Finally, for organizations needing to keep data on-premise, Power BI Report Server ensures data security [2].

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Power Query is the data transformation engine that allows a user to clean data or shape and transform data that is loaded into a model. Power Pivot enables advanced calculations and modeling with DAX. The Power BI Gateway allows on-premise data sources to connect to the cloud service and be scheduled for refreshes. The Power BI Report Builder is to create paginated reports even to be printed. Other components of Power BI include visualizations that display data in graphical form, workspaces where teams can collaborate on a report, and dataflows that will provide reusable data preparation logic for multiple reports and models.

Data Analysis Expression (DAX) is a mathematical language that enables custom calculations in Power BI, Power Pivot in Excel, and other Microsoft data analysis tools. DAX allows you to write expressions to derive new insights based on your existing data models, and it is a core feature when performing complex analyses such as growth percentages, year-over-year variations, and more. DAX is a formula language for relational data, designed to provide engines with analytical capabilities beyond raw data. DAX supports several types of calculations, including measures, which are context-dependent calculations; calculated columns, which add a new value to existing tables; and calculated tables, which create a new table from existing tables. DAX is comprised of over 200 functions to perform mathematical, statistical, and other calculations – evolution of information through viewing textual and logical information and time-intelligence analyses. DAX also separates itself from Excel as DAX formulas work on tables and columns of data, using the relationship between data to access data relationships [3].

DAX Copilot and its components, using Power BI, will coalesce and innovate clinical documentation and analytics in healthcare through their respective strengths. DAX Copilot will take documentation and analytics staff and relieve them of the burden of clinical documentation by automatically automating it, creating structured clinical data, and extract medical insights. Power BI will then take operationalize structured clinical data and medical insights into interactive dashboards and metric to take informed action. This workflow reduces time spent on the clinical documentation and analytics process while automating all notes taking and reporting, while increasing efficiency and time-saving decision-making. The combination of data flows will allow for real-time visualizations without the need for data preparation of the structured data stream all leveraging a lakehouse architecture developed by Microsoft Fabric. Moreover, Power BI was intended to amplify the users' ability to analyze health care data with DAX Copilot's natual language process and conversational style functionalities built into their software experience, which can be liberating for users without heavy technical backgrounds. Accuracy and compliance was also negotiated and improved in the AI-generated screw report as a transparent and documented activity, which also provided the resilience that many health care organizations need with a continual level of chronic and progressive change. The Power BI and DAX Copilot integration has a distinctive ability to incentivize efficiency while concurrently improving the accuracy and insights of the clinical documentation and health care analytics process[4].

DAX Copilot offers a new way for users to build, comprehend and govern DAX queries, particularly useful and timely for complex scenarios involving healthcare. DAX Copilot accelerates DAX formula building by converting a user's simple human thought or question into accurate query code. This simplifies DAX with a notable decrease in the demand for users to remember or learn DAX syntax, while also alleviating the user coding problems. DAX Copilot establishes opportunities for technical and non-technical users to collaborate and share knowledge by providing immediate, plain language descriptions for a DAX measurement, creating a path for both users to share their reasoning and engage with implications mentors to each. DAX Copilot further elevates the end-user experience within Power BI by confirming syntax checks, streamlining and fixing errors, as well as allowing for minuscule adaptations to a query or calculation.

DAX Copilot is an interactive application that serves as an extra interactive application of Power BI “Desktop,” Power BI “Service,” and Microsoft “Fabric.” More than anything else, it extends the engagement of users with their datasets through a conversational interface to continue to improve upon the questions they ask. DAX Copilot makes it easier for users to navigate quickly to actionable insights to empower business decisions based on data rather than waiting the response from a trained analyst to synthesize data into action. DAX Copilot will also enhance clinician productivity, as it will help with converting the data quickly into a report, and by being able to eliminate some of the data collection, allowing more time to care for patients. In general, DAX Copilot speeds the creation of DAX queries, provides a simplicity for level(s) of technical ability, and with the collaborative aspect of clarifying questions and checking for errors, along with the seamless integration within the Microsoft data ecosystem. When used appropriately, it can help with the complex data analysis process providing a pathway to democratizing advanced business intelligence [5].

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## II. BACKGROUND AND RELATED WORK

By the year 2025, the incorporation of artificial intelligence, electronic health records, and data analytics technology will have created a significant improvement in documentation and analytics for the clinical setting, with positive effects on the burden of documentation, accuracy, and compliance. Providers of health care still are relying upon documentation that is mostly templated documentation that leads to subpar diagnostic coding and clinical context impacting quality of patient care and remuneration. The lack of alignment of clinical team, coder team has also garnered attention. Clinical documentation integrity programs have been implemented to consider the improvement documentation quality. Emergent, proactive, data-driven clinical documentation integrity programs are being implemented with the assistance of artificial intelligence that helps clinical teams to identify and resolve documentation deficiencies before the claim is submitted and assist with audit readiness, increasing payment cycles and reducing claim denials altogether. AI-driven technology systems apply natural language processing, speech recognition, machine learning to conduct automatic transcription of audio conversations between patients and clinician, provide medical codes, and identify documentation deficiencies that reduce burnout and lessen documentation time by up to 50%.

A number of healthcare analytics platforms are beginning to leverage this newer clinical data to generate insights that assist in monitoring compliance, tracking outcomes, and increasing operational efficiency. The trend of using cloud data lakes and lakehouse architectures will support analytics and predictive AI-supported analytics that leverage advanced analytics to deploy scalable and secure data storage. The 2025 environment will be largely dependent on AI assisted documentation technologies for coding that leverage automatic transcription; greater exposure to machine learning for enhanced proactive CDI program at various stages of maturity; ongoing development of AI integrated EHR solutions; and, ongoing emphasis on value based care through high quality documentation. Advanced analytics technologies (e.g., Power BI) will provide actionable insight regarding clinical data and promote improvements in documentation quality, lessen administrator burden, and move the healthcare system closer to a data-driven approach.

DAX Copilot is an AI assistant that functions in Power BI Desktop and Power BI Service that is designed to help users with DAX queries and conversational querying and semantic data models to create DAX queries, edit their DAX queries, and understand DAX queries. This feature ultimately helps speed up the ability to create DAX measurements, report designs, data analysis, and visualizing data for business users with differing levels of technical capabilities. Productivity and utility of DAX Copilot can be extended through the use of tools like DAX Studio and Tabular Editor that offer advanced capabilities for things like performance tuning and debugging the DAX queries, especially for more advanced users working with complex measurements. GPT-based AI technologies have also been utilized by members of the Power BI community to create and debug DAX syntax, illustrating the growing importance of Artificial Intelligence in business intelligence and healthcare analytics [7].

DAX Copilot allows users to build DAX formulas to review time-contrast data by recommending writing code or using natural languages to allow a user to select traditional, hand-written DAX or AI-generated DAX. This helps new users reduce the learning curve and save writing time, albeit DAX Copilot may not possess the codifying optimization functions offered by an experienced user. Experienced users can optimize and modify hand-written DAX while DAX Copilot's function is limited to their training data and parsing the model metadata. DAX Copilot does eliminate errors with respect to checking potential schema context and syntax issues; however, the output is dependent on the prompts associated with the application type, and it may not be appropriate for all applications. In all cases, well-structured DAX provides accuracy and output performance consistently, and the DAX is continuously updated through the experience of analysts or developers. [8]

Power BI's AI model DAX Copilot assistant makes it simple to create, change, and explain DAX queries with a natural language prompt. It creates accurate and well-notated DAX code that allows for quicker report development and quicker learning of analysis, especially for users without extensive knowledge of DAX. The conversational experience helps facilitate team-based learning and reduces the time to develop by allowing the user to recreate the DAX query more easily, check the syntax, and provide of inline explanations. On the other hand, an experienced analyst may prefer hand-written DAX as they can execute complex logic, increased efficiency, and long-term scalability.

Hand-written DAX can help create specialized, high performance analytics solutions but usually requires more expertise and time. Overall, DAX Copilot democratizes DAX programming and allows for flexible and quick development while providing DAX learning opportunities to novice users, while hand-written DAX is necessary to ensure refined analytics and the viability of complex DAX queries that require precise control and maintenance over time. This bridge builds a range of users and possibilities in business intelligence and healthcare analytic reporting,

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while increasing productivity and quality of analytics technology and reporting in Power BI systems. DAX created by hand is crucial to build high-quality, complex business intelligence systems much faster, while DAX created by Copilot provides a simpler, quicker data analysis operation that can be more accessible to end-users overall. The pros and cons of both are shown in the table below under Table 1:

| Aspect | Copilot-generated DAX | Hand-written DAX |
|---|---|---|
| **Ease of Use** | User-friendly, natural language interaction lowers barriers | Requires deep DAX expertise and coding skills |
| **Speed of Development** | Rapid query and measure generation via AI suggestions | Slower due to manual coding, testing, and debugging |
| **Accessibility** | Suitable for non-experts and beginners | Best for experienced analysts and developers |
| **Optimization** | Basic optimizations; may miss complex context or scalability improvements | Allows complex tuning including context transitions and refactoring |
| **Customization** | Limited by AI model flexibility and training data | Full control for tailored, standards-compliant coding |
| **Error Handling** | Built-in syntax checks and AI error detection | Requires manual debugging and testing |
| **Explainability** | Provides natural language explanations to aid understanding | Depends on documentation and code commenting by author |
| **Collaboration** | Facilitates team learning via query explanations in natural language | Collaboration relies on shared code standards and communication |
| **Scalability** | Suitable for average data loads | Highly scalable with optimized hand-coded queries |
| **Maintenance** | May depend on AI model updates and improvements | Maintained and evolved by expert developers over time |

**Table 1:** Comparing the Pros and Cons of Copilot-generated DAX versus Hand-written DAX

## III. SYSTEM ARCHITECTURE

The Medallion design pattern is the basis for Microsoft Fabric's lakehouse architecture, which organizes data into three quality levels: bronze, silver, and gold. This multi-layered structure promotes the transformation of raw data into an analytics-ready state, while maintaining scalable business analytics across a single source of truth. The bronze layer is the intake layer for unstructured, or semi-structured, or structured raw data with no transformations. Data is obtained from a wide range of sources, including Internet of Things (IoT) devices, transactional sources, and more. The silver layer of the data lakehouse processes, cleans, and validates data and generates structured data sets, all of which are deemed appropriate for operational reporting. The gold layer consists of data models that have been scrubbed and aggregated to a high level in order to best utilize the data for their intended analytics purposes while fostering data stewardship and assurance through governance and periodic refreshes. The lakehouse data architecture strikes a successful balance between the scalability of data lakes and the trustworthiness of data warehouses by providing a path for the effective management of the data lifecycle. Thus, it invites others to work with stakeholders, as well as use tools like DAX Copilot and Power BI to facilitate analytics in a more cohesive manner. Overall, the Medallion design pattern offers a pragmatic and functional framework for modern data work across sectors, including healthcare [9].

A complete process using AI, data structures, and consolidated storage of data has been implemented to record, transcribe, and store clinical dialogue in Microsoft Fabric. The DAX Copilot, during patient encounters, listens, in an audio format, to clinical exchanges with as many parties as present, transcribes this audio into a text format, and generates notes and narrative summaries in a specialty-specific format. This near real-time documentation is meant to improve accuracy and reduce the burden of documentation on healthcare providers. After capturing the audio and written transcripts, the data is stored in the Bronze layer of the Medallion architecture in Microsoft Fabric's OneLake. At the Silver layer, data will be cleaned, validated, and enhanced using Spark notebooks or SQL engines, specifically formatting it into a common standard according to healthcare data standards, i.e. FHIR or OMOP. Unstructured clinical notes will be augmented by AI and Natural Language Processing in order to provide the necessary metadata needed to perform analyses.

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The Gold layer comprises a set of cleaned and curated clinical data that can be utilized commercially, for reporting, analysis, or machine learning applications. The data is available in Power BI and DAX Copilot, allowing the creation of interactive dashboards for operational management and clinical decision-making. The data is stored in a hierarchical fashion for ease of retrieval and collaboration, stored IN a secured location and consistent with healthcare standards and regulations (e.g. HIPAA). This method provides a single source of truth for managing healthcare data and reporting healthcare intelligence through the standardization and scalability of this approach. It takes raw conversation collection into clinical analytics that can be valuable for the management of clinical services. Microsoft Fabric engages clinicians and generates workflows that promote collaborative clinical encounters into actionable data assets that promote patient care and clinician productivity through AI-driven capture, automated transformation pipelines, and a state of the art lakehouse architecture.

The DAX Copilot data flow into OneLake on Microsoft Fabric is a simple process, demonstrated in the below Figure 1, that involves data ingestion, transformation, and a storage component:

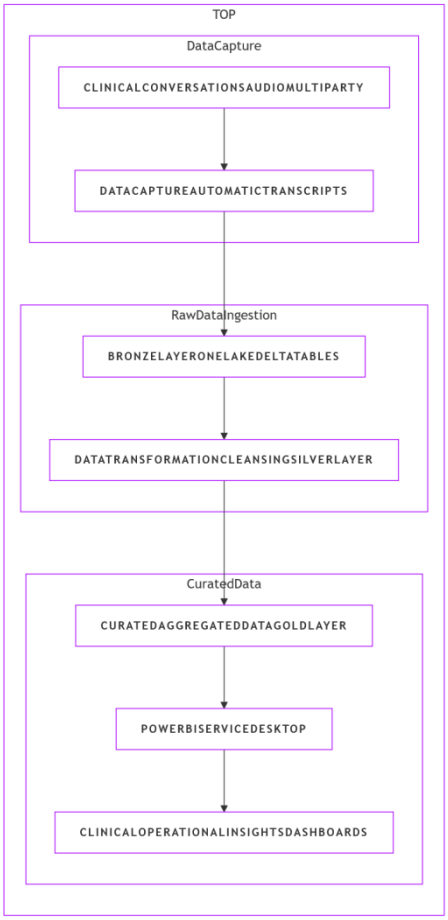


**Figure 1:** End-to-End Data Flow for DAX Copilot into Microsoft Fabric's OneLake

1. Clinical Conversation Capture: AI-powered speech recognition captures patient-clinician conversations at the point of care.
2. Automatic Transcription: Conversations are transcribed into text and formatted into clinical documentation, which contains coded entities and summaries.
3. Substrate Data Ingestion (Bronze Layer): Original and un-processed transcripts and artifacts will save into OneLake as Delta tables for traceability and the option for reprocessing.
4. Data Cleansing, Transformation and Enrichment (Silver Layer): Raw data that is pulled will be cleansed, normalized, and enriched through additional tools and will map to healthcare standards and additional medical metadata.

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5. Preparing the Curated Dataset (Gold Layer): The curated dataset will generate a usable dataset to consumers for analytics. The gold layer will provide common clinical and operational KPIs from various areas and provide consistent KPIs.
6. Utilize Power BI with DAX Copilot: The Discovery users will transition to the Gold layer through Power BI either via access to the gold layer using SQL Analytics or access and use DAX queries through Direct Lake APIs.
7. Actionable Insights & Reporting: Managers, data analysts, and clinicians will use live interactive Power BI dashboards to gain actionable insights, monitor performance, and make data-driven decisions.

OneLake provides integrated, secure, and governed storage for high-performance analytics and collaboration while enabling the recording for diagnostic metadata for compliance tracking. This pipeline represents a modern healthcare data lifecycle which is powered by Microsoft Fabric to leverage the AI-enabled clinical insights from unstructured interactions and simplify to create value.

Within Microsoft Fabric's OneLake, the Gold layer provides a source of prepared business data for reporting & analytics. This is the main connection for Power BI to access datasets that have been curated to one degree or another. In Power BI, the semantics are defined in the semantic model, and then that is the model that connects to OneLake and can access that data by interacting directly with the Delta tables (i.e. using the Direct Lake storage method). The Direct Lake storage option gives the user real-time or nearly real-time data access without having to migrate the delta tables. If the Gold layer is within what would be considered a dedicated Fabric Data Warehouse, Power BI connects through the standard SQL endpoints so that a user can query the well-structured data. DAX Copilot is a new feature that allows the user to create and build DAX queries in an interactive manner. This enhancement in DRAX modeling will improve the user's experience and will increase productivity in the analytics process and report development.

Security protocols are in place for users utilizing Power BI, including role-based access control & data governance policies to ensure compliance to the organization & data privacy for users. The product supports refreshing the Power BI semantic model (via Dataflows) in both an on-demand refresh and in a scheduled refresh to the user's Power BI reports based on the tracking or connection of data in OneLake. Cache also enhances the speed of query layouts. This infrastructure allows the user to explore clinical and operational data in the highest quality, while simultaneously accommodating for governance, scalability, and performance demands that modern healthcare analytics require.

Utilizing Microsoft Fabric's DAX Copilot and OneLake for healthcare has demonstrated a significant increase in clinical efficiency and completion of documentation. For example, physicians who utilize Fabric's artificial intelligence-based transcription and summarization technologies save approximately 7 minutes per patient in documentation, which is about a 50% increase of time that they can spend with patients. As a result, hospitals achieve an average of 11-12 additional patients seen (or taken care of) by physicians each month, and without extending their work hours, the processes in need of completion become less lengthy, and Microsoft Fabric manages the documentation for them. A private hospital in the Middle East, provided operational efficiencies to aggregate unique or disparate data sources, including different EHR (Electronic Health Record) systems into one reporting application to generate over 70 federally mandated reports in less than a month that had alternate to a higher utilization of IT staff, which increases autonomy of the department. AI generated clinical documentation also increased safety and throughput by decreasing clinical errors to generate discharge summaries by utilizing summarization and technology [10].

Healthcare administrators' testimonials illustrated the benefits of Microsoft Fabric, with comments that it allows clinicians to spend more time on what matters - patient care, and an automated discharge summary improves communication and reduces delays. Additionally, real-time dashboards automate the care coordination process by tracking resource utilization, wait time, and bed counts, allowing for workflows to be automated, data-informed decisions to be made, and improved patient outcomes across the health system, leveraging Microsoft Fabric's Medallion architecture, the OneLake data platform, integrated AI services, and Power BI analytics with DAX Copilot.

By offering automation, increased accuracy, a reduction in human error, and collaboration, Microsoft Fabric can provide tremendous benefit to the healthcare industry. It automates administrative tasks for caregivers and clinical staff such as clinical documentation, scheduling visits, and includes the use of AI agents to help augment care teams or institutes, which can allow for more time with patients. AI-enabled natural language processing (NLP) pulls data from a combination of systems to increase precision at scale by combing and assessing information reduction of human error while generating a dataset of higher quality. Within this data is a DAX Copilot feature, which detects and removes errors in queries, calculations, and analytics; automation furthers this with a layer of data integrity, ensures quality, and facilitates compliance. App data flows seamlessly between clinical teams and partners, which establishes an integrated

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OneLake data storage layer that enables patient data & operational data to flow seamlessly between clinical teams and partners. Analytics become available to both technical and non-technical users. Overall, the aim for healthcare operations is to streamline operations, promote data-influenced decision-making in-clinical practice, and drive patient engagement through better patient outcomes while enabling reasonable governance and compliance; organizations can take cumbersome healthcare data or analytics and turn them into actionable insights help clinicians and health systems deliver better care [11].

AI-based healthcare technologies, such as DAX Copilot, are devoted to identifying different key project domains that are aligned with data-driven analytics and health care requirements and includes but is not limited to the design and development of applications that are independent of platforms and software, the execution of international project management and implementation, as well as the assurance of quality to provide the best users experience. AI projects evolve with collaboration of all stakeholders in healthcare while also having security features that will protect information that is sensitive in nature. There will also be the assistance and support to stakeholders when advanced-build AI models are integrated into their clinical data documents and documentation process. DAX Copilot has improved workflow efficiencies in the clinical professional sectors by creating new workflows that will decrease documentation and clinician burnout for as much as five minutes per patient encounter or interaction, on average, for clinicians. Surveys have stated that approximately 70% of physicians have reported better work-life balance and better communication with patients through DAX Copilot. Additional features of the artificial intelligence plan are being created, such as an encounter summary or encounter page, and some features are customizable, allowing for quicker workflows, and the specializing of desires and experiences. The partnership of projects with Microsoft Fabric also creates ease of usage on the mobile device. DAX Copilot has also been launched and then utilized in global sectors that include, but are not limited to, the US, UK, France, and Germany, as they reduce distractions in the workplace and allow for advanced automation that will assist in advancing clinical documentation from conversations into clinical notes or documentation [12].

The Figure 2 below depicts improvement in clinical documentation efficiency and operational effectiveness by leveraging DAX Copilot and Microsoft Fabric, indicating demonstrated improvements in performance metrics, such as a 50% reduction in average documentation time per patient perceived by clinicians, 70% reduction in clinician burnout rates, and a 70% reduction in report generation time. The results also indicate an increase in the number of daily patients observed and improved accuracy of discharge summaries, leading to higher overall patient engagement, reduced reporting time, and easier documentation procedures.

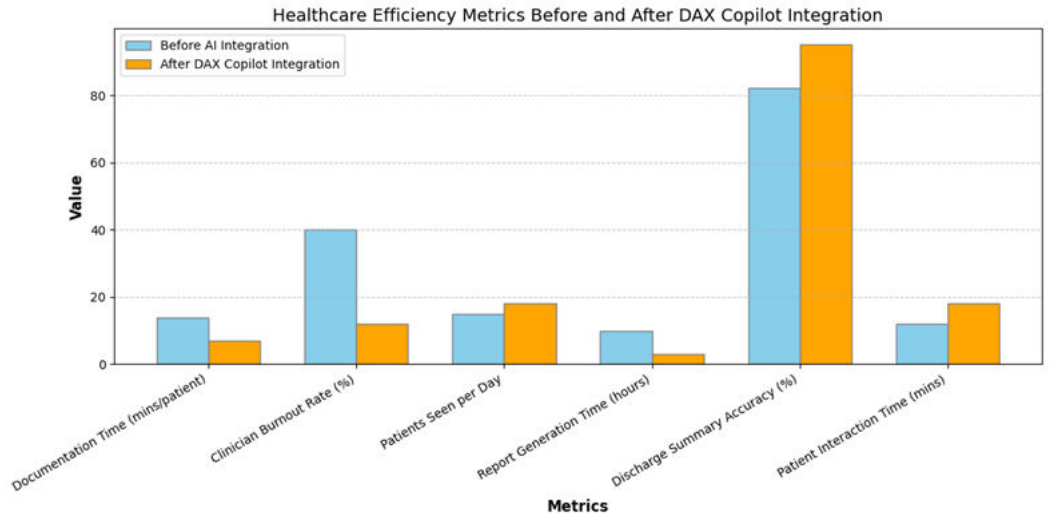


**Figure 2:** Healthcare Efficiency Metrics Before and After DAX Copilot Integration

## IV. CONCLUSION

DAX Copilot and Power BI are changing healthcare analytics and documentation by improving accessibility, accuracy, and efficiency. With this combination, healthcare professionals can support the documentation and analytics for the user, by automating some of the more complex work to find data and generate reports, thereby reducing the physician's

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fatigue and increasing time with the patient. The generative AI capabilities of DAX Copilot for formula authoring, combined with Power BI's visualization capabilities, help get this information across much faster, with a more precise timely insight, improving the experience for the patient and increasing efficiency for healthcare professionals. More accurate reporting and timely operational metric documentation allows healthcare administrators to make timely decisions, and platforms with scalable analytics can also help with scalability, compliance, and better patient outcomes due to seamless access to results. AI powered collaboration tools reinforce teamwork and data literacy across the continuum of skill level. The possibilities for the future extend beyond Healthcare and will be useful in all areas of interest, resulting in considerable intensity for data analytics. In the end, frontiers will focus on the development of natural language processing, integration of multi-knit data sources, and almost constant advancements in AI models at work and home and will continuously support change toward intelligent or AI-enhanced data analytics ecosystems in our future. This will support intelligent and AI-enhanced health care ecosystems to meet the demands of personalized and efficient delivery of care in clinical and operational work.

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