

A dirt path leads through a dense forest, flanked by a rustic wooden fence. Sunlight filters through the trees, creating a warm, golden glow on the path. The background is filled with various types of trees and foliage, including ferns and bare branches.

Artificial Intelligence in Healthcare

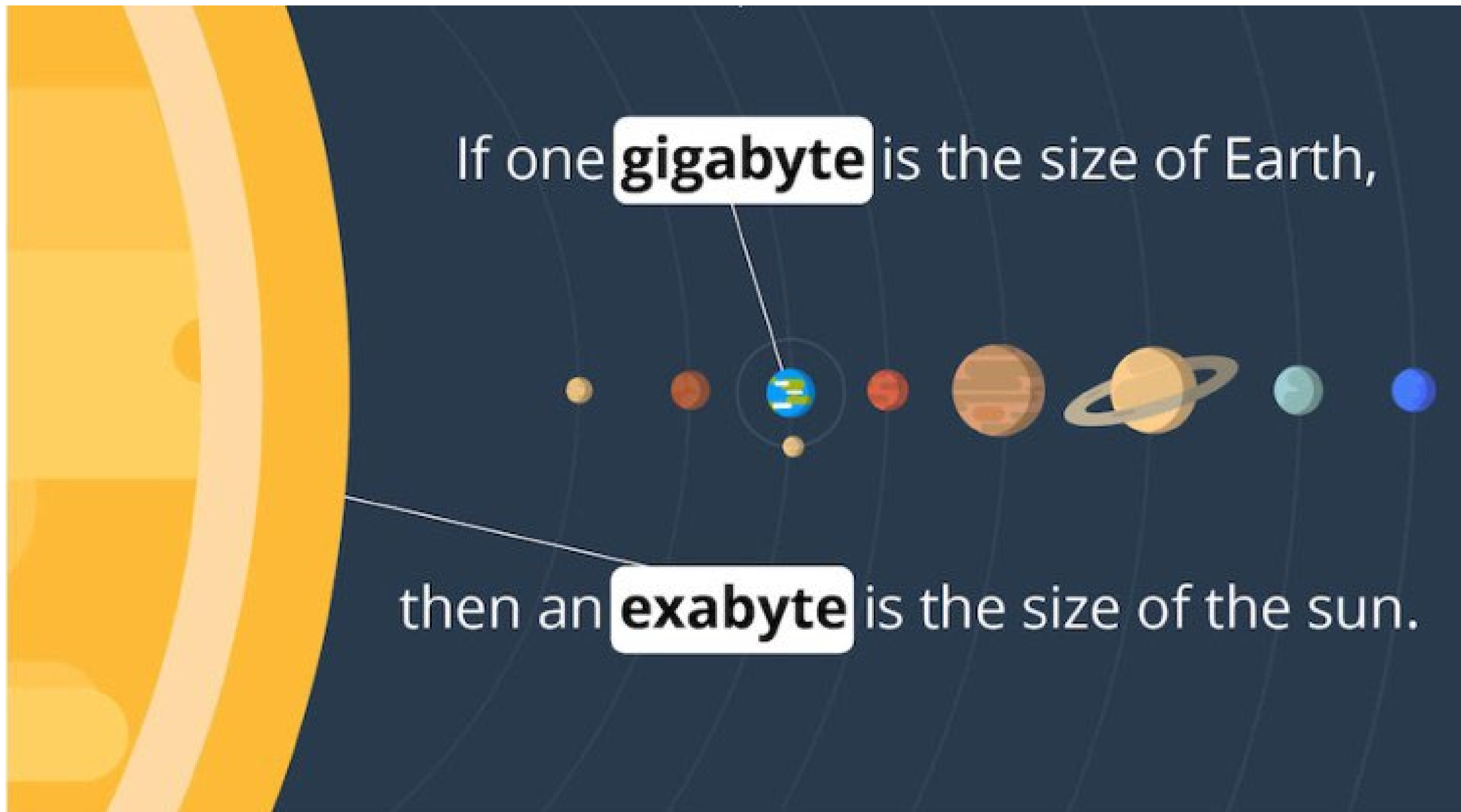
Brian Kay, PhD

State of Healthcare

- Average margin for health systems in 2024 2.4%
 - 3% is considered as a comfortable operating margin
- **Nursing Shortages:** The United States is experiencing a critical shortage of nurses, with a reported need to hire at least 200,000 new nurses annually to meet rising demands. Despite these efforts, over 56% of nurses reported experiencing burnout, further straining the workforce and contributing to high turnover rates. Some departments, such as emergency care, have seen turnover rates spike from 18% to as high as 30% .
- **Physician Shortages:** There is also a projected shortfall of up to 124,000 physicians by 2033, which reflects the ongoing difficulty in attracting and retaining doctors in various specialties, particularly in rural areas where shortages are more pronounced.

If one **gigabyte** is the size of Earth,

then an **exabyte** is the size of the sun.



Increasing amounts of Health Data

Historical Context:

- **2013:** The global volume of healthcare data was around **153 exabytes**. At that time, data was primarily generated through traditional sources such as medical records, imaging, and administrative documents.
- **2016:** Health data doubled approximately every 24 months, reaching an estimated **800 exabytes** due to the increasing adoption of digital health technologies.
- **2020:** With the widespread implementation of Electronic Health Records (EHRs) and the growth of digital health tools, global healthcare data exploded to **2,314 exabytes**.
- **2023:** The pace of data creation accelerated further with the integration of advanced medical imaging, remote monitoring devices, and AI-driven diagnostics, surpassing **3,000 exabytes**.

Future Projections:

- **2025:** The volume of healthcare data is expected to grow exponentially, with predictions indicating it could reach **36 zettabytes** (36,000 exabytes) annually. This growth is fueled by the continued expansion of personalized medicine, real-time data collection from wearables, and the increasing use of telehealth services.

Comparison to Other Industries:

- Healthcare data is growing faster than data in other industries like manufacturing, finance, and retail. This is due to the complex and multi-faceted nature of healthcare, which encompasses diverse data types, from clinical records to behavioral data, and the high frequency of data generation.

Administrative Burden

Time Consumption:

- Clinicians spend an estimated **34.0% of their work time** on administrative tasks rather than direct patient care .
- For every hour of patient interaction, clinicians spend **an additional 2 hours** on EHR and desk work .
- **Up to 40%** of a physician's day may be spent on documentation and other administrative tasks .

Increased Workload:

- The average physician works approximately **11 hours per day**, with about **4.5 hours** dedicated to administrative work .
- **Over 70%** of clinicians report that the administrative burden has increased significantly over the past decade .

Burnout:

- **More than 50%** of healthcare professionals report experiencing burnout, with administrative tasks cited as a leading cause .
- Burnout rates among physicians are linked to the amount of time spent on EHRs and other administrative duties .
- **A 2023 survey** found that **80%** of clinicians believe that reducing administrative tasks would significantly lower their stress levels .

Reduced Patient Interaction:

- **One study** found that doctors spend only **27% of their time** on direct clinical face time with patients, with the remainder being consumed by administrative tasks .
- The reduction in patient interaction time has been associated with decreased patient satisfaction and trust in the healthcare system
- **Patient wait times** have increased by **30%** in some practices due to the administrative burden on clinicians .

Healthcare is ripe for application of AI

1. Electronic Health Records (EHRs):

1. The widespread adoption of EHRs has been a fundamental change in the storage and accessibility of patient data.

2. Wearable Technology:

1. The proliferation of wearable devices that monitor health metrics like heart rate, sleep patterns, and physical activity has led to an explosion of data. These devices contribute to personalized medicine by providing continuous, real-time health monitoring data to both patients and physicians.

3. Genomic Data:

1. Advances in genomic sequencing technology have led to a dramatic increase in the availability of genetic data. This genomic data is crucial for personalized medicine, allowing for treatments tailored to the genetic profiles of individual patients.

4. Imaging Data:

1. Improvements in medical imaging technology, such as MRI and CT scans, have resulted in higher-resolution images, which generate more data. This has enhanced diagnostic capabilities but also increased the volume of data that healthcare systems need to manage.

5. Telemedicine:

1. The growth of telemedicine, especially accelerated by the COVID-19 pandemic, has led to new forms of data collection from virtual consultations and remote patient monitoring, integrating more sources of health data into medical records.

6. Interoperability and Data Sharing:

1. There has been a significant push towards improving interoperability between different health systems and data platforms, which facilitates the broader sharing and analysis of health data. This helps in creating more comprehensive patient profiles and supports public health monitoring and research.

7. Big Data and AI:

1. The use of big data analytics and artificial intelligence in healthcare has grown, enabling the analysis of vast amounts of data for insights into patient care, operational improvements, and predictive analytics.

Three Major Applications



INCREASED OF ACCESS TO
CARE



INCREASED PRODUCTIVITY
AND REDUCE ADMINISTRATIVE
BURDEN ON CLINICAL STAFF

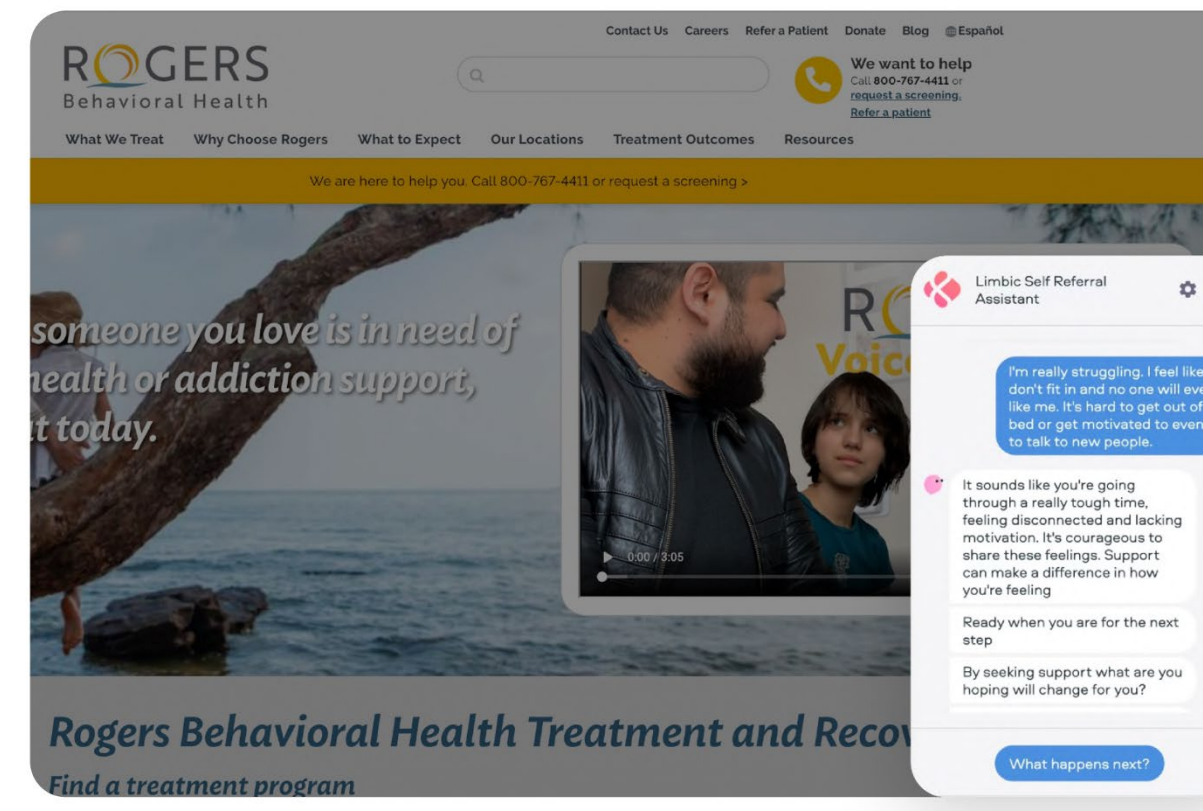


PERSONALIZED MEDICINE

Increased Access

- Traditional phone-based consumer facing process is a barrier for those seeking treatment
- Social anxiety or stigma prevents individuals from calling to seek behavioral health services
- Wait times or call backs on the 800 number discourages people from seeking help
- There is difficulty reaching consumers during off-hours.
- A large amount of calls are inquiry calls (40%)
- Web submission form still requires a call back and missed opportunity to connect with patient
- UK-based AI company specializing only in Behavioral Health
- AI validated on 300,000 individuals in various levels of care, with strategies to reduce bias
- Exceptional publication record, published in high impact journals such as Nature Medicine

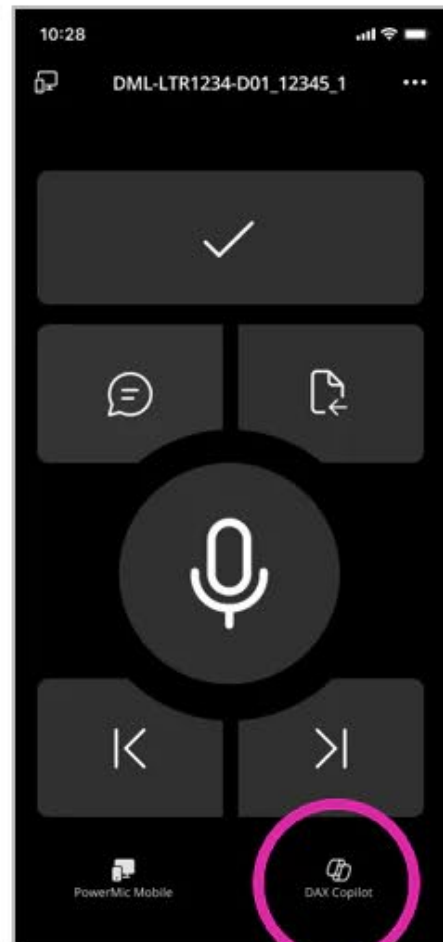
and British Medical Journal



Ambient listening for documentation

- **Automatic Documentation:** Ambient listening systems can automatically transcribe conversations and generate clinical notes in real-time. This reduces the burden on clinicians to manually enter data into Electronic Health Records (EHRs), which is often a time-consuming and error-prone task.
- **Enhanced Patient Engagement:** By minimizing the need for clinicians to type or write during consultations, ambient listening allows them to maintain better eye contact and engage more fully with patients, improving the overall patient experience.
- **Improved Accuracy:** Advanced AI algorithms are used to ensure that the captured information is accurate and relevant, helping to reduce errors in clinical documentation. The system can also flag inconsistencies or missing information that may need further clarification.

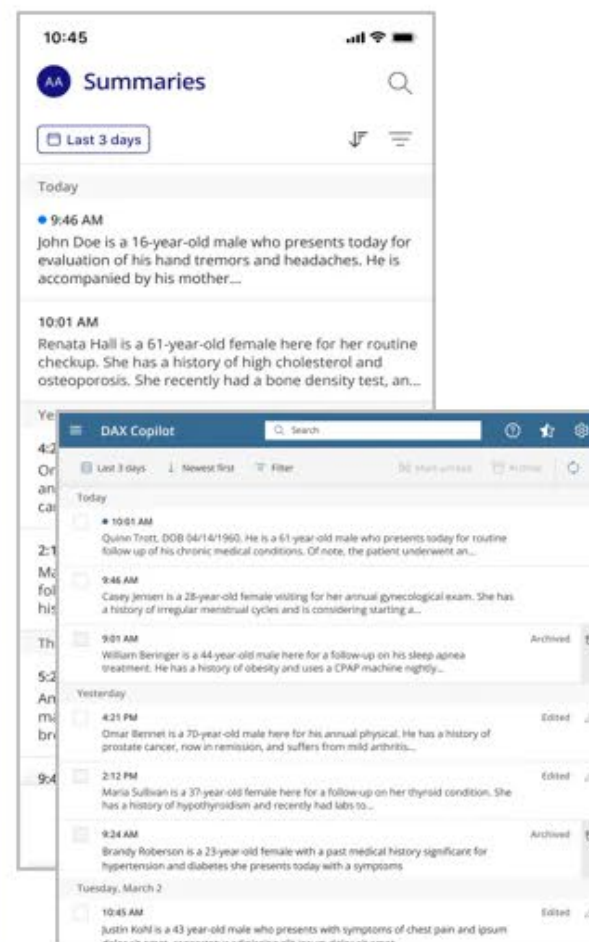
Access via mobile app



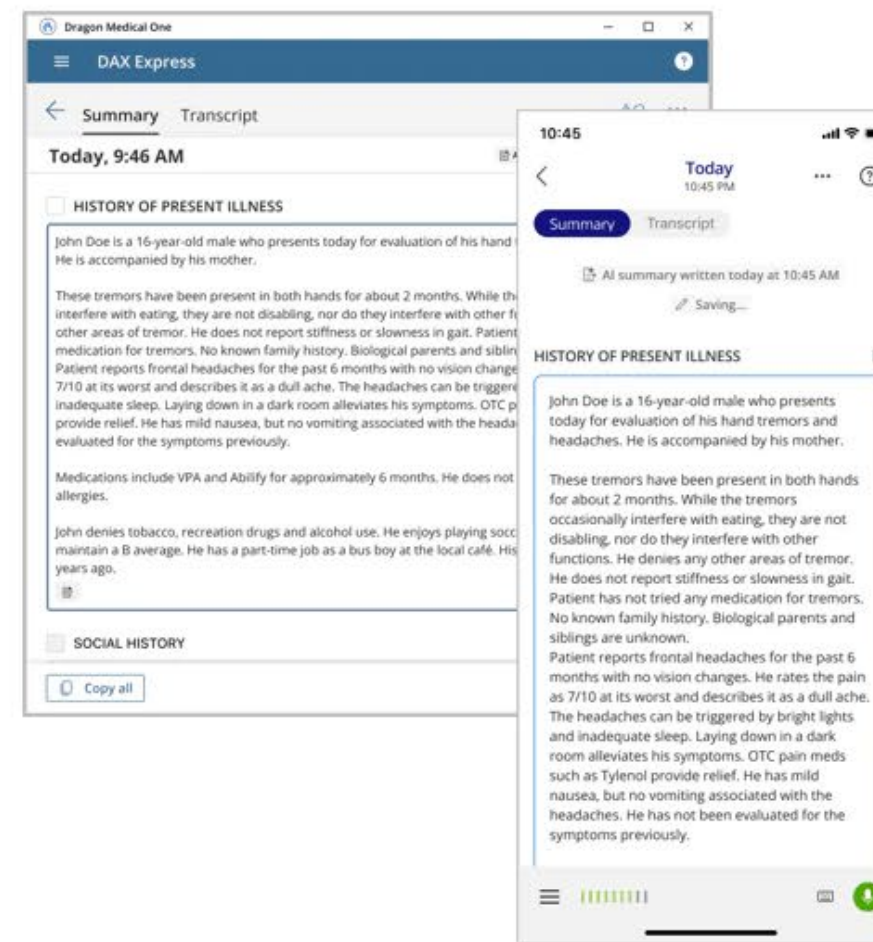
Record conversations in the app



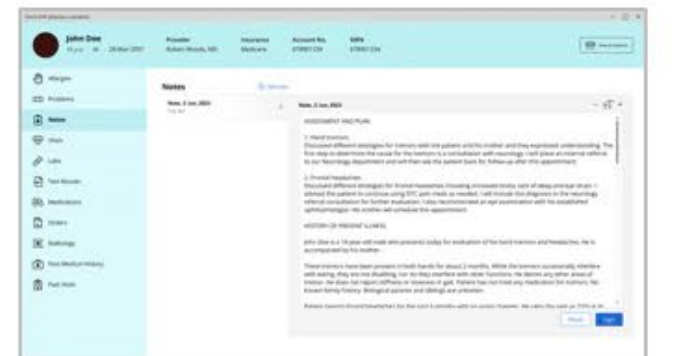
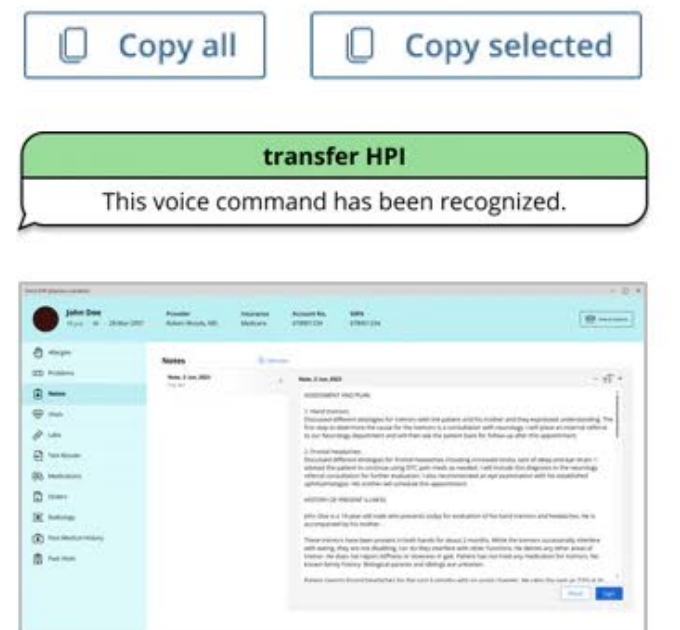
View summaries in mobile app or on desktop



Review and edit clinical summaries in mobile app or the DAX Copilot window in Dragon Medical One



Transfer to EHR with a single voice command or direct insert on desktop



Treatment plan personalization

- Utilizing algorithms that will enable us to predict patient outcomes based on initial assessment data (i.e., admission data)
- To predict patient's overall treatment response
- To assist our clinical staff to optimize their therapeutic intervention for patients
- Ultimately to help improve treatment success rates for patients under our care
- Through the use of the algorithm 36% of individuals went from “Partial Response” to Response by discharge

Healthcare must focus on explainable AI

1. Diverse Data Collection:

1. Ensure that the data used to train AI models is representative of all relevant aspects of the population. This includes addressing issues of underrepresentation or overrepresentation of certain groups.

2. Bias Detection and Mitigation Techniques:

1. Employ statistical and computational techniques to detect and mitigate bias in AI models. This includes analyzing model predictions for fairness across different groups and adjusting the model or its training data accordingly.

3. Transparent and Explainable AI:

1. Develop AI systems that are transparent and explainable, allowing users and developers to understand how and why decisions are made. This transparency helps in identifying potential biases in decision-making processes.

4. Inclusive Development Team:

1. Assemble diverse teams to design and develop AI systems. Diversity in terms of race, gender, cultural background, and professional expertise can help in recognizing and eliminating unconscious biases.

5. Ethical Guidelines and Standards:

1. Establish and adhere to ethical guidelines and standards for AI development. This includes guidelines for fairness, accountability, and transparency.

6. User Feedback:

1. Incorporate continuous feedback from users to understand how AI applications perform in the real world and how they impact different groups of people.

7. Cross-Disciplinary Approaches:

1. Involve experts from various fields, such as sociology, psychology, and ethics, in the AI development process to ensure a broad perspective on potential impacts.

AI Nutrition Facts	
Generative Journeys in Twilio Engage	
Description	Accelerate campaign execution by using language prompts to describe a campaign journey. Marketers can apply additional filters but then let CustomerAI create the journey and target the appropriate audience.
Privacy Ladder Level	1
Feature is Optional	Yes
Model Type	Generative
Base Model	OpenAI - GPT-4
Trust Ingredients	
Base Model Trained with Customer Data	No
Enter comment here...	
Customer Data is Shared with Model Vendor	No
Journey prompts are NOT used for training OpenAI models	
Training Data Anonymized	N/A
Data Deletion	Yes
Journey inferences deleted after 30 days	
Human in the Loop	Yes
User sees output immediately in UI User must choose to publish journey	
Data Retention	30 days
Compliance	
Logging & Auditing	Yes
Guardrails	Yes
Input/Output Consistency	Yes
Other Resources	
Learn more at: https://www.twilio.com/en-us/customer-ai	

Learn more about this label at [nutrition-facts.ai](https://www.twilio.com/en-us/customer-ai)

Key Take Aways

- AI will not replace clinicians and providers, but will be a powerful tool to augment decision making
- AI will reduce administrative burden on clinicians
- There will be disparities in outcomes between hospitals that utilize AI and those that do not
- Data security and privacy is paramount
- Ethical considerations need to be taken into account from training to implementation