



# The Life Sciences & Health Care Generative AI Dossier

A selection of high-impact use cases

By Deloitte AI Institute



[www.deloitte.com/us/generative-ai-dossier](https://www.deloitte.com/us/generative-ai-dossier)



## About the Deloitte AI Institute

The Deloitte AI Institute™ helps organizations connect all the different dimensions of the robust, highly dynamic, and rapidly evolving Artificial Intelligence ecosystem. The AI Institute leads conversations on applied AI innovation across industries, with cutting-edge insights, to promote human-machine collaboration in the “Age of With™.”

The Deloitte AI Institute aims to promote the dialogue and development of AI, stimulate innovation, and examine challenges to AI implementation and ways to address them. The AI Institute collaborates with an ecosystem composed of academic research groups, start-ups, entrepreneurs, innovators, mature AI product leaders, and AI visionaries to explore key areas of artificial intelligence including risks, policies, ethics, the future of work and talent, and applied AI use cases. Combined with Deloitte’s deep knowledge and experience in artificial intelligence applications, the Institute helps make sense of this complex ecosystem, and as a result, delivers impactful perspectives to help organizations succeed by making informed AI decisions.

No matter what stage of the AI journey you are in: whether you are a board member or a C-Suite leader driving strategy for your organization—or a hands-on data scientist bringing an AI strategy to life—the Deloitte AI Institute can help you learn more about how enterprises across the world are leveraging AI for a competitive advantage. Visit us at the Deloitte AI Institute for a full body of our work, subscribe to our podcasts and newsletter, and join us at our meet-ups and live events. Let’s explore the future of AI together.

[www.deloitte.com/us/AIInstitute](https://www.deloitte.com/us/AIInstitute)

The image shows a large, dark blue, stylized 'Deloitte' logo on a light-colored wall. The logo is written in a bold, sans-serif font. A small green dot is positioned at the end of the word, to the right of the final 'e'. The logo is slightly angled upwards from left to right.

# Introduction

The advent of Generative AI has delighted and surprised the world, throwing open the door to AI capabilities once thought to be still far off in our future. With a remarkable capacity to consume and generate novel outputs, Generative AI is prompting excitement and stimulating ideas around how this type of AI can be used for organizational benefit. Far more than a sophisticated chatbot, Generative AI has the potential to unleash innovation, permit new ways of working, amplify other AI systems and technologies, and transform enterprises across every industry.

This compendium highlights 60 of the most compelling use cases for Generative AI across six major industries:

- **Consumer** (which includes Consumer Products, Retail, Automotive, Lodging, Restaurants, Travel, and Transportation)
- **Energy, Resources, and Industrial** (ER&I)
- **Financial Services** (FSI)
- **Government & Public Services** (GPS)
- **Life Sciences & Health Care** (LSHC)
- **Technology, Media, and Telecommunications** (TMT)

For each of these industries, we explore Generative AI use cases that can address enterprise challenges in new ways, permit more and greater capabilities across business functions, and deliver advantages in efficiency, speed, scale, and capacity.

As with any type of AI, there are potential risks. We use Deloitte's Trustworthy AI™ framework to elucidate factors that contribute to trust and ethics in Generative AI deployments, as well as some of the steps that can promote governance and risk mitigation. Trustworthy AI in this respect is: fair and impartial, robust and reliable, transparent and explainable, safe and secure, accountable and responsible, and respectful of privacy.

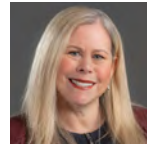
To be sure, this collection of use cases is just a sample among myriad other applications, some of them yet to be conceived. As Generative AI matures as a technology and organizations move forward with using it for business benefit, we will likely see even more impressive and compelling use cases. The applications highlighted here can help spark ideas, reveal value-driving deployments, and set organizations on a road to making the most valuable use of this powerful new technology.



**Nitin Mittal**  
**Global Generative  
AI Leader**  
Deloitte Consulting LLP



**Beena Ammanath**  
**Global Deloitte AI  
Institute Leader**  
Deloitte Consulting LLP



**Lynne Sterrett**  
**US Generative AI Market  
Activation Leader**  
Deloitte Consulting LLP



**Jim Rowan**  
**US Head of AI**  
Deloitte Consulting LLP

# Six key modalities

One of the primary differences between more traditional AI and Generative AI is that the latter can create novel output that appears to be generated by humans. The coherent writing and hyper-realistic images that have captured public and business interest are examples of Generative AI models outputting data in ways once only possible with human thought, creativity, and effort. Today, Generative AI models can create outputs in six key modalities.



## Text

Written language outputs presented in an accessible tone and quality, with details and complexity aligned with the user's needs.

Examples include summarizing documents, writing customer-facing materials, and explaining complex topics in natural language.



## Code

Computer code in a variety of programming languages with the capacity to autonomously summarize, document, and annotate the code for human developers.

Examples include generating code from natural language descriptions and autonomously maintaining code across different platforms.



## Audio

Much like textual outputs, audio outputted in natural, conversational, and even colloquial styles with the capacity to rapidly shift among languages, tone, and degrees of complexity.

Examples include Generative AI-powered call centers and troubleshooting support for technicians in the field.



## Image

Textual or visual prompts lead the model to create images with varying degrees of realism, variability, and "creativity."

Examples include simulating how a product might look in a customer's home and reconstructing an accident scene to assess insurance claims and liability.



## Video

Similar to imagery, Generative AI models can take user prompts and output videos, with scenes, people, and objects that are entirely fictitious and created by the model.

Examples include autonomously generating marketing videos to showcase a new product and simulating dangerous scenarios for safety training.



## 3D/Specialized

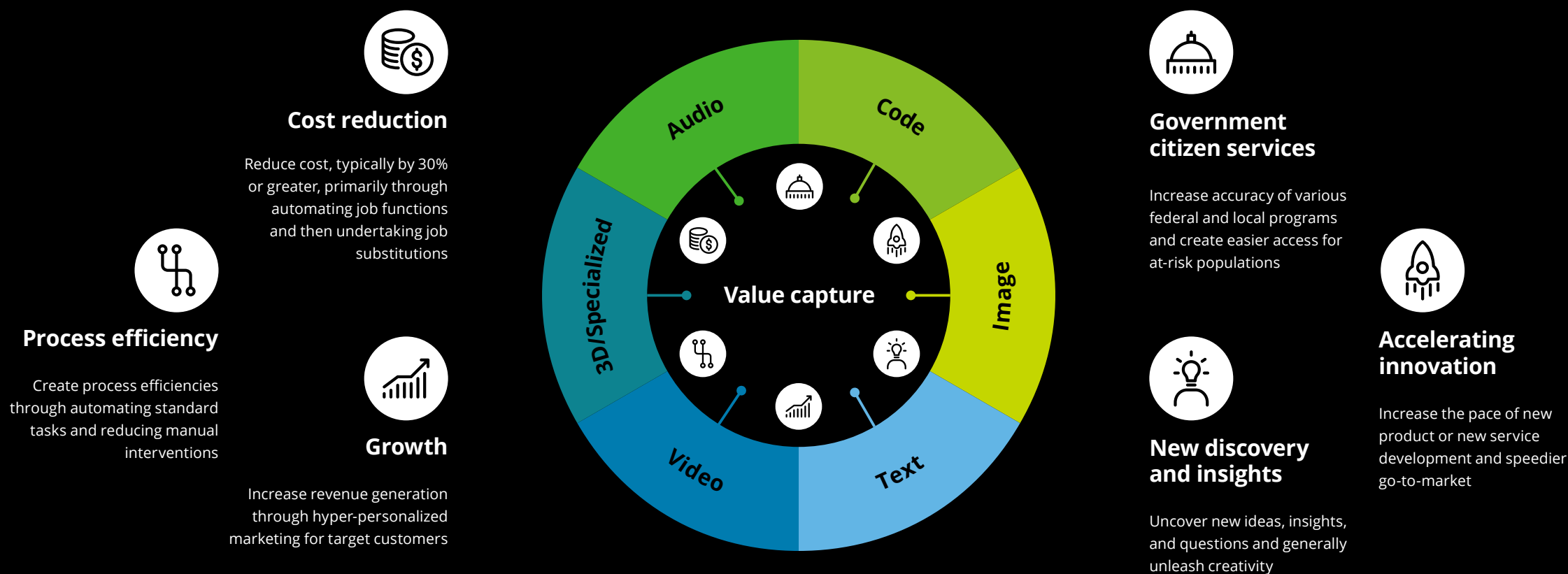
From text or two-dimensional inputs (e.g., images), models can extrapolate and generate data representing 3D objects.

Examples include creating virtual renderings in an omniverse environment and AI-assisted prototyping and design in a purely virtual space.

By understanding these modalities, organizations are empowered to think through and better understand the kinds of benefits Generative AI could permit. For each use case described in this dossier, there may be more than one value-driving modality. A chatbot text output could be presented as simulated audio; a generated image could be extended into a video. Ultimately, the Generative AI use case and the value the organization seeks will determine which output modalities can contribute the greatest advantages and outcomes.

# Broad categories of value capture from Generative AI

The value that Generative AI use cases can enable can be conceived across six dimensions: cost reduction, process efficiency, growth, innovation, discovery and insights, and government citizen services. To be sure, a single use case can drive more than one value capture, but to help paint the vision for how Generative AI can be used to move the needle on competitive differentiators and operational excellence, the use cases described in this dossier are each associated with a primary value capture.







**The Life Sciences and Healthcare (LSHC) industry has been a vibrant testing ground for new AI capabilities. Facing large data volumes, health maladies that demand new and better treatments, an aging global population, an array of regulatory obligations, the complexity of claims processes, and the challenge of sharing patient information between organizations, LSHC enterprises seek greater efficiency, speed, connectivity, and innovation, all to drive patient care and better health outcomes. Generative AI can help transform healthcare and life sciences companies in three archetypical ways.**

First, Generative AI can be used to improve operational performance through improved employee productivity. In essence, it can help organizations achieve more with less. It can be used to automate aspects of claims authorization and appeal, optimize R&D processes, and drive waste out of procurement and contracting. It can also improve and scale population health reporting and analytics to drive consistency in care, and it can boost speed to market for offerings, customer engagement, and drug commercialization. By accessing these advantages without adding new burdens to the existing workforce, the efficiency gained through these kinds of deployments can have a direct impact on the enterprise bottom line and generate long-term stakeholder value.

Second, Generative AI can be used to provide N of 1, fit-for-purpose, and hyper-personalized experiences to patients, customers, and employees. Deployments that improve experiences can optimize the customer and patient journeys, focus on health outcomes (rather than services), and enable new digital products and offerings. With Generative AI, patient and customer engagement content can be hyper-personalized at scale. Innovations such as like virtual therapy and virtual care assistants move toward differentiating services that can enhance the quality of care and health outcomes.

Innovations such as virtual therapy and virtual care assistants move toward differentiating services that can enhance the quality of care and health outcomes.

Third, Generative AI can be used to develop and enhance enterprise digital and data capabilities. As a component of the organization's technology ecosystem, Generative AI can help uncover insights by using an intuitive interface to more easily interrogate enterprise code and datasets. It can help extend asset utility by consuming unstructured data from across the enterprise systems and making predictive recommendations, and it can improve decisioning with intelligent semantic search. There are also valuable advantages for the workforce by augmenting skills and knowledge and adapting to human resource challenges, like human capital shortages and burnout.

Together, these opportunity to improve efficiency, experience, and data capabilities can accelerate time to market, enhance agility, and build toward the work, workforce, and workplace of the future.

As a component of the organization's technology ecosystem, Generative AI can help uncover insights by using an intuitive interface to more easily interrogate enterprise code and datasets.





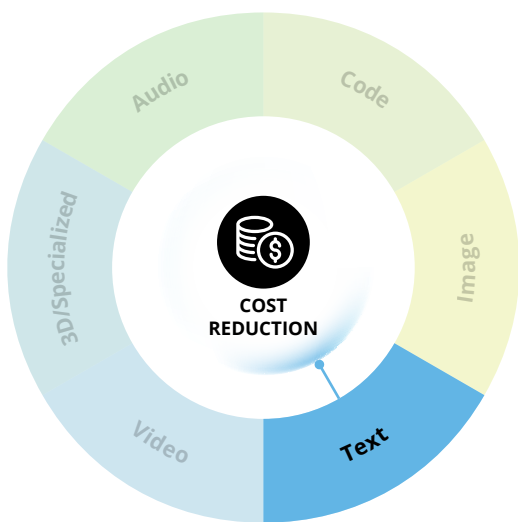
# A co-writer for appeals

## (Denial Appeal Letters)

**Generative AI can be used to draft denial appeal letters, drawing from patient records and medical policies and guidelines in a faster, more cost-effective way than human staff.**

### Issue/opportunity

When a medical insurance claim is denied, hospital billing staff face a costly and lengthy process of reviewing patient records and medical policies to create an appeal letter. For US hospitals, appeals-related administrative costs are measured in billions of dollars. Part of the challenge is the amount of time required for staff to compile an appeal. While more than 60% of denied claims are recoverable, vague reasons for denial and limited hospital billing resources result in only 0.2% of in-network claims being appealed, with millions of dollars written off as uncollectable loss each year.<sup>1</sup>



## How Generative AI can help

### Retrieving policies and guidelines

A Generative AI retrieval model can reach across large volumes of medical policies and member plans to identify the necessary information for a claims appeal.

### Extracting patient data

Using extractive algorithms, the organization can rapidly consult unstructured medical notes, medications, lab results, and other electronic health records.

### Writing the appeal

With the necessary information gathered with AI, an LLM can be used to generate an appeal letter.



# A co-writer for appeals

## Managing risk and promoting trust



### Accountable

When consulting highly detailed guidelines, policies, and records to appeal a claim denied for vague reasons, the Generative AI models working together to create the appeal may misinterpret the denial or the records, leading to an unsuccessful appeal. Ultimately, a human needs to be accountable for validating appeal letters.



### Privacy

By drawing from electronic health records, the model is consuming health information whose protection is subject to laws and regulations. Ensure that the data ingestion and information outputted aligns with data protection and patient privacy expectations.

## Potential benefits

### Reclaim revenue

Automating the denial appeal process can supplement hospital billing resources, leading to more denial appeals filed and potentially more revenue recovered.

### Efficiency improvement

The implementation of advanced legal technologies can greatly enhance the speed and efficiency of appeals, such as drafting and substantiating, when compared to traditional manual methods. They have the potential to streamline processes across both simple and complex cases, making the legal workflow considerably more time-effective.

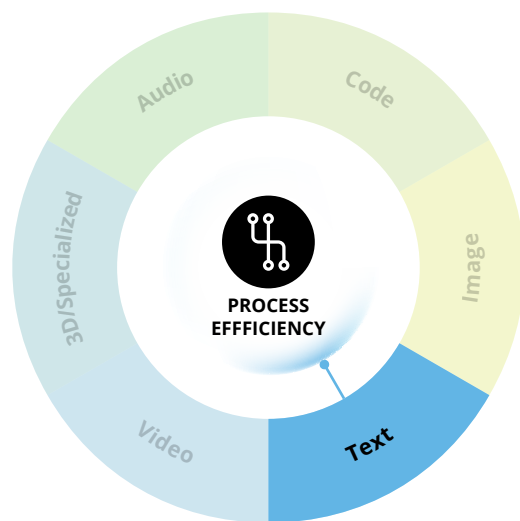




# Faster admin for payers, providers, and patients

## (Accelerated Prior Authorization)

**Using Generative AI to consume medical policies, guidelines, and provider-submitted information about underlying issues, patient needs, and medical history, the organization can automate a Prior Authorization submission (Provider) or generate a Prior Authorization approval or denial (Payer).**



### Issue/opportunity

The Prior Authorization process is manual and labor-intensive for both healthcare payers and providers. The process requires the input of coders who understand the intent of a payer's Prior Authorization policies, as well as the need for medically necessary care management plans. The time required to consume medical records and policies to make determinations on Prior Authorization submission, approval, or denial can lead to a long administrative process between the payer and provider, which can negatively impact patient satisfaction and the customer experience.

## How Generative AI can help

### Supporting the provider

For providers, Generative AI can help prepare a Prior Authorization submission by analyzing submission requirements and guidelines and cross referencing with a patient's medical records to ensure necessary requirements are met. Generative AI can then aid in submission to the payer and continually learn which best practices tend to lead to Prior Authorization approvals.

### Supporting the payer

For payers, Generative AI can help reduce the time required to make a Prior Authorization decision, impacting the patient experience. It also helps mitigate fraud by determining if there are anomalies in a provider's coding practices and promoting compliance by analyzing submitted Prior Authorization requests and records against the payer's policies and procedures.

### More efficient operations

For both payers and providers, using Generative AI for Prior Authorization processes reduces work burdens and streamlines the ability to respond to Prior Authorizations, which can reduce costs while improving patient experiences.

# Faster admin for payers, providers, and patients

## Managing risk and promoting trust



### Security

Prior Authorization requires the provider and payer to communicate sensitive patient data, such as protected health information (PHI) and personally identifiable information (PII), etc., which means this data is exposed to the model. Risks included unauthorized third-party access, as well as AI systems inadvertently revealing sensitive information during the generation process, thus compromising patient data confidentiality.



### Bias

The process for submitting and responding to Prior Authorization involves a standard set of Prior Authorization rules and the patient's medical history, which introduces the potential for bias in Generative AI models. This bias might arise due to the historical data used to train the model (e.g., disparities in healthcare treatment or outcomes), and as a result, the Generative AI model could inadvertently perpetuate and even amplify such biases by making biased decisions or recommendations. The use of standardized authorization rules and patient-specific medical history, alongside continuous monitoring and careful evaluation, helps mitigate this risk and promotes fairer and more equitable outcomes.



### Reliable

While the process for submitting and responding to Prior Authorization requires a standard set of Prior Authorization rules and the patient's own medical history, there is a risk that the model will misinterpret nuanced medical conditions of underrepresented populations that were not in the training dataset, and so falsely deny the need.

## Potential benefits

### Speed and efficiency

With Generative AI, providers and payers may require less time to understand policies, research patient medical records for compliance, and generate, approve, or deny a Prior Authorization request.

### Continuous learning

A Generative AI feedback loop refers to the cyclical process where the AI model's output is presented to users or evaluators for feedback, which is then used to iteratively update and refine the model. This enhances the consistency and quality of outputs, enabling providers to gain a deeper understanding of payer policies, streamline decision-making processes, and ultimately allowing payers to optimize their procedures.

### Improved patient experience

As the Prior Authorization process becomes more efficient, patients can receive the care management they need without needless waiting for administrative processes to conclude. This supports increased patient satisfaction by virtue of improved administrative and patient experience.



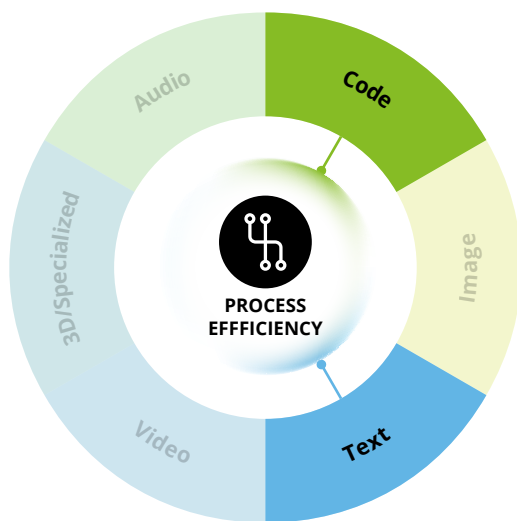
# Simplifying claims submission

## (Medical Coding)

**Generative AI can be used to create code for a claims department to categorize incoming claims and billing for medical services and procedures, which can improve the accuracy, efficiency, and speed in the claims submission process.**

### Issue/opportunity

The claims submission process in the medical industry can be laborious and error-prone, involving the manual categorization of a large volume of incoming claims with complex medical codes. This time-consuming task leads to backlogs, delays, and potential payment issues for healthcare providers.



## How Generative AI can help

### Transformed claims processing

Using Generative AI to help categorize incoming claims and analyze and assign accurate codes can improve the overall accuracy, efficiency, and speed of claims processing. This results in faster reimbursements for providers and a streamlined experience for both the claims department and patients.

### Reduced labor burden

By leveraging an LLM, the human workload in the claim's submission process can be redirected to higher value-added tasks which could result in administrative cost savings for the payer.



# Simplifying claims submission

## Managing risk and promoting trust



### Fair and impartial

A Large Language Model (LLM) used in medical billing may be susceptible to bias owing to skewed training data, incorrect labels, and under-represented cases, potentially leading to incorrect claim categorization. To mitigate these issues, careful data collection, diverse model testing, and continuous monitoring and adjustment are vital for ensuring fair and accurate performance.



### Privacy

To assess coding accuracy, the LLM compares the billed codes with the patient medical history, which exposes the patient's data to the underlying model and creates potential privacy risks that need to be mitigated.



### Reliable

Medical coding is highly regulated with strict penalties for over/under coding. The accuracy and reliability of LLM outputs in this regard is essential, as mistakes could carry consequences. Reliability may be challenging in part because patient medical history may contain multiple modalities (e.g., text, images, and video).

## Potential benefits

### Accuracy to limit revenue loss

Leveraging an LLM can help reduce the risk of coding errors. This can help increase billing accuracy and decrease revenue loss due to errors.

### Time efficiency

Automating the review of medical records can save valuable time for healthcare practitioners, enabling them to focus on more meaningful work.



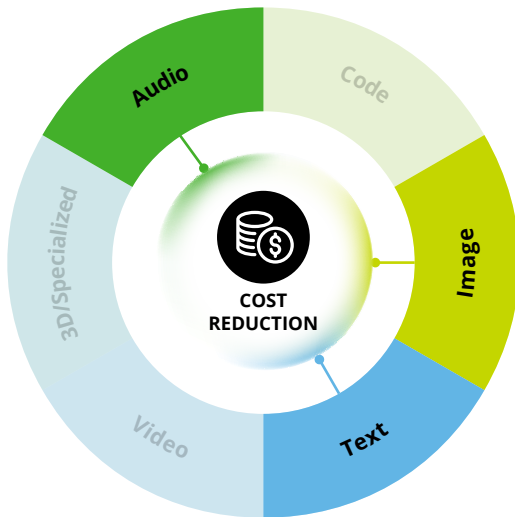
# Personalized service for patients

## (Claims Assistant)

**Generative AI can assist human staff in generating responses to customer questions about the claims process, insurance coverage, and other plan details.**

### Issue/opportunity

The customer service experience has a direct impact on patient perception, even without any change in charged costs or appointment wait times. This is particularly relevant in the context of payer call centers, where patients can spend significant time navigating Interactive Voice Response (IVR)-based responses. Operational inefficiencies or limited capacity in the call center can translate to decreased customer satisfaction. What is needed is a method for supporting more customers more quickly while also reducing call volumes handled by associates.



## How Generative AI can help

### Sorting customer archetypes

Customer claims questions often fall into archetypes, such as “claim status,” “coverage status,” and “explanation of benefits.” A Generative AI model can be fine-tuned on these archetypes to address nuanced, customer-specific needs.

### Improving the customer experience

Generative AI can support the IVR process by cross referencing the patient’s medical and claims history to create a more personalized and comprehensive user experience. It can also summarize next steps on the patient’s account for future follow-up.

### Supporting human staff

Live agents can be supported by having the AI model summarize customer questions, compare it to past successful resolutions and remediation plans, and provide real-time recommendations for next steps. In some instances, the Generative AI model may be able to function as a live agent.

### Increasing capacity

By leveraging web-based textual support in conjunction with the call center, payers can use Generative AI to respond accurately and empathetically to customer questions, simultaneously serving more customers while deflecting contact center inbound call volumes away from the associate, unlocking new operational efficiencies.

# Personalized service for patients

## Managing risk and promoting trust



### Fair and impartial

The presence of geographic and socioeconomic bias implicit in claim or plan details may lead the system to provide less accurate responses to customers from underrepresented regions or socioeconomic backgrounds.



### Reliable

Generative AI outputs may not always be accurate, and with the risk of hallucination, the AI could return responses that are misaligned with claim or plan details.

## Potential benefits

### Enhanced customer satisfaction

When live agents can provide real-time, personalized feedback and answers to the customer, it improves the overall customer experience when inquiring about plans and benefits.

### Increased efficiency

When IVR is augmented and improved with Generative AI, the model can handle simple or straightforward customer inquiries while more complex questions are directed to a live agent.

### Strategic insights

Generative AI can process customer and text analysis to reveal trends and insights, such as the types of claims/visits causing the most issues, when customers are most upset, and the topics that tend to confuse customers the most. These insights can inform strategic decisions for the payer and provider.



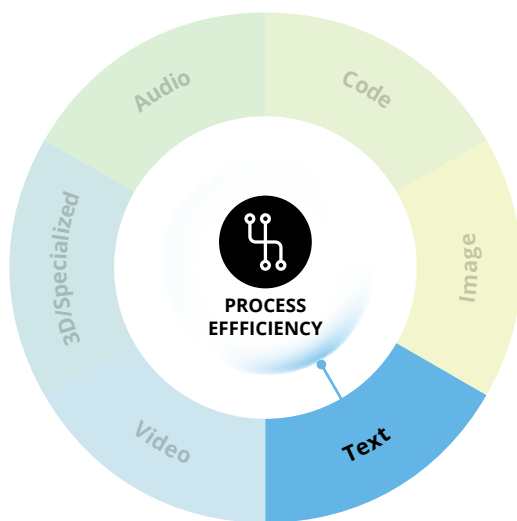
# A physician's message manager

## (Provider In-Basket Management)

**An LLM can be used to process messages in a healthcare provider's in-basket, accelerating responses while liberating physicians to focus on patient-facing care.**

### Issue/opportunity

The amount of time required for primary care providers (PCP) to accomplish both administrative and patient care responsibilities can exceed what is possible in a day. In some cases, upwards of two-thirds of time is spent on administrative, non-patient facing work. The 21st Century Cures Act encourages electronic medical records (EMR) in-basket usage, which led to a dramatic increase in in-basket messages during the COVID-19 pandemic. The result is significant burdens on PCPs, which is contributing to physician burnout.<sup>2</sup>



## How Generative AI can help

### Triaging the in-basket

Generative AI can be used to review routine messages (e.g., Rx refills, scheduling) and delegate simpler tasks to automation.

### Message assistant

PCPs can leverage Generative AI to summarize complex clinical messages for review and use the model to draft replies for provider input and response. Drafts are informed by the model consulting prior in-basket replies and EHR data.

### Insights at scale

By using AI-enabled in-basket message systems at scale, organizations can identify issues related to patient negativity in their messages. The insights into complaints, expressions of dissatisfaction, frustration, confusion, or concern about care can inform interventions that may improve the patient experience.



# A physician's message manager

## Managing risk and promoting trust



### Security

Use of AI in in-basket systems involves collecting, processing, and storing large amounts of sensitive patient data, such as medical history, diagnoses, and treatment plans. This data is subject to strict privacy laws, and any unauthorized third-party access could result in legal and financial consequences for healthcare providers.



### Accountable

If messages are composed or summarized with inaccurate information, it could lead the PCP to erroneous decision making or poor patient engagement, which can have significant consequences for patient health, trust in the healthcare provider, and the reputation of the organization.

## Potential benefits

### Physician support

By using an AI-enabled in-basket system, the PCP's time-consuming administrative tasks are reduced, permitting more patient-facing work and mitigating one cause of physician burnout.

### Timely responses

A more efficient process for working through in-basket messages can lead to faster responses to patient needs, contributing not only to be a better patient experience but potentially also better health outcomes.

### Patient sentiment

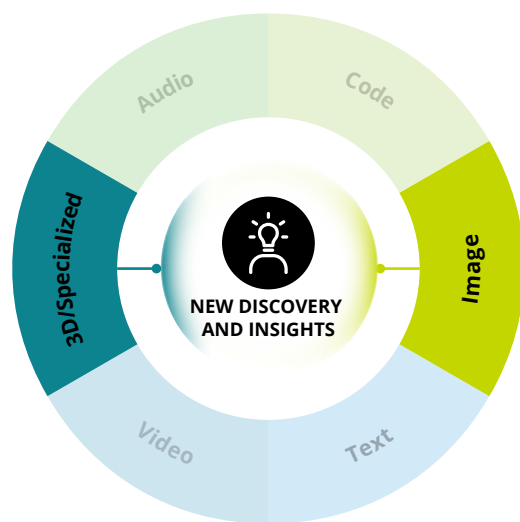
By identifying and tracking signals of negativity at scale, healthcare providers can gain insights into common pain points in the patient experience. This could help them proactively address these issues, whether by adjusting their practices, improving communication, or implementing other interventions to enhance patient satisfaction.



# Unlocking the cures

## (New Drug Discovery/Generation)

**Generative AI can be used to model the structure and function of proteins and biomolecules, accelerating the identification and validation of molecules and the creation of new drug candidates.**



### Issue/opportunity

Despite advancements in medical treatments, numerous diseases still lack effective solutions due to the complex, costly, and time-consuming process of drug discovery and verification. The challenge of drug development lies not just in discovering potential treatments but also in the rigorous verification of their effectiveness, a process that is both costly and time-consuming. Compounding these issues are the unique complexities of clinical trials, which need to account for diverse populations, varied interactions with other treatments, and potential side effects. Furthermore, the rarity of some diseases creates additional hurdles due to limited data from fewer patients, making the development even more challenging.

## How Generative AI can help

### Cost reduction

The use of Generative AI in the verification of drugs during clinical development could significantly reduce costs. This is due to its ability to run simulations and select the best potential candidates for further testing, thereby minimizing the need for extensive real-world iterations.

### Promoting public health

Generative AI has the potential to significantly improve public health by accelerating the discovery of better treatments and cures for diseases. Its ability to analyze and learn from vast amounts of data can lead to more targeted, effective treatments, directly benefitting patients and, by extension, society at large.

### Enabling collaboration

Generative AI can facilitate improved communication and knowledge sharing across research groups. It can process and make sense of data from various sources, breaking down data silos and opening new opportunities for collaboration and innovation in experimentation.

# Unlocking the cures

## Managing risk and promoting trust



### Transparent

Generative AI can play a vital role in enhancing transparency in data collection and sharing. Using Generative AI to track and document all data processes, from sourcing to utilization, can help ensure that all stages of data collection and sharing are transparent, auditable, and compliant with established standards. This, in turn, can foster trust among stakeholders, prevent the monopolization of the domain, and accelerate innovation.



### Responsible

Monitoring current and evolving regulations early in the process is crucial to gaining public trust and ensuring ethical Generative AI deployment. By demonstrating a responsible approach to AI implementation and adhering to established regulations, organizations can prevent misunderstandings and help ensure that scientific progress is not slowed by regulatory issues.

## Potential benefits

### Cost reduction

The use of Generative AI in the verification of drugs during clinical development could significantly reduce costs. This is due to its ability to run simulations and select the best potential candidates for further testing, thereby minimizing the need for extensive real-world iterations.

### Promoting public health

Generative AI has the potential to significantly improve public health by accelerating the discovery of better treatments and cures for diseases. Its ability to analyze and learn from vast amounts of data can lead to more targeted, effective treatments, directly benefitting patients and, by extension, society at large.

### Fostering collaboration

Generative AI can facilitate improved communication and knowledge sharing across research groups. It can process and make sense of data from various sources, breaking down data silos and opening new opportunities for collaboration and innovation in experimentation.



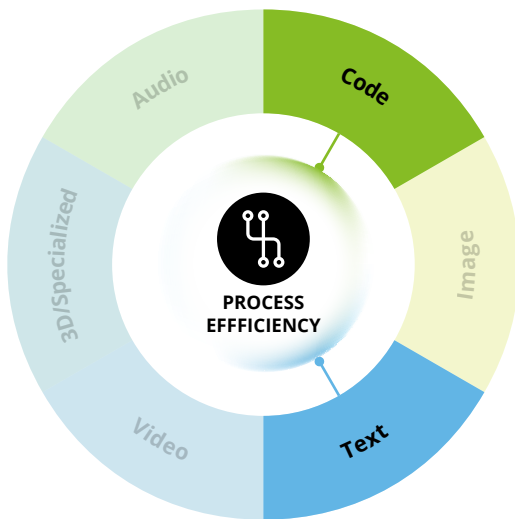
# Democratizing model creation

## (Knowledge Domain Model Development)

**Generative AI can remove UI hurdles with reinforcement learning (RL) without need for tech staff.**

### Issue/opportunity

Developing novel models for LSHC continues to demand a high degree of technical proficiency to perform data exploration, feature engineering, model training, and evaluation. Frequently, the steps involved in model training lack a user-friendly interface, posing accessibility challenges for healthcare professionals and domain experts who may not possess extensive technical backgrounds. Simultaneously, the quality and relevance of model outputs hinges significantly on domain expertise and practical experience. Overcoming this divide between technical acumen and domain knowledge remains the primary obstacle in harnessing the complete capabilities of AI within the field of LSHC.



## How Generative AI can help

### Empowering professionals

With its capacity for learning from and adapting to iterative feedback, Generative AI can act as an enabler for professionals across various sectors. It offers the opportunity to continually refine domain-specific models by adding new training data. This iterative enhancement increases the model's accuracy, utility, and relevance to the user's specific professional needs. In this way, Generative AI can empower professionals by providing them with tailored, precision tools that evolve with their work.

### Streamlining healthcare model development

Generative AI can help simplify model development in the complex and highly-regulated healthcare industry. By focusing on intuitive user interface designs and automated processes, Generative minimizes UI obstacles, making it more accessible for professionals to refine and improve their models. Consequently, this increases the effectiveness and accuracy of models in healthcare, driving more efficient outcomes.

### Improving alignment

Generative AI leverages reinforcement learning (RL) techniques, a type of machine learning where an AI system learns to make decisions by trial and error, to validate and improve its outputs. This process assists in mitigating prevalent AI challenges, including hallucinations or confabulations, ambiguity, and colloquialism misuse. As a result, it bolsters the AI's reliability and furnishes professionals with more precise models and predictions, thus aligning AI capabilities more closely with user requirements.



# Democratizing model creation

## Managing risk and promoting trust



### Reliable

Hallucinations or confabulation could lead to the execution of incorrect procedures or use of suboptimal reagents and equipment, causing inaccurate experiments and inefficient use of resources. Particularly in medical or pharmaceutical labs, inaccurate information could even lead to compliance or regulatory issues.



### Transparency

The Generative AI system itself incorporates tools that offer transparency into the data engineering pipelines, including data preparation stages. This inherent transparency facilitates an understanding of the AI's functioning within the organization, fostering trust in the accuracy and reliability of the AI system's outputs. It is a crucial component of the AI use case, demonstrating the system's accountability and promoting its acceptance across the organization.

## Potential benefits

### Enhance institutional knowledge access

Generative AI can help reduce institutional knowledge loss due to employee exits and enable on-demand access to domain-specific knowledge across the organization.

### Increase development throughput

Domain area experts can drive more self-sufficient model experimentation and development by utilizing model outputs in natural language and synthesizing insights about optimal procedures, reagents, equipment, and techniques into a comprehensive and accessible format.

### Cost management

This approach to model development empowers employees to take part in model experimentation, reducing costs associated with MLOps and technical specialists.



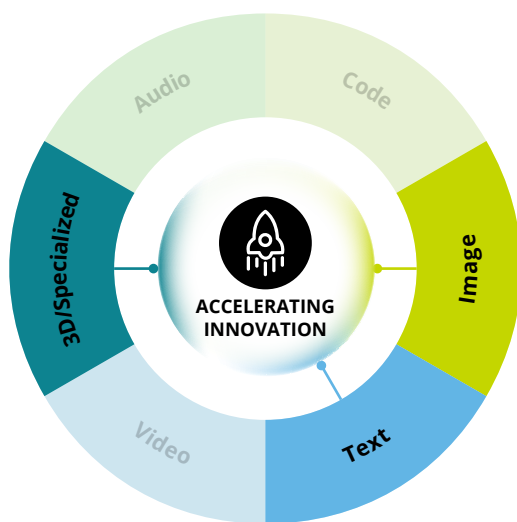
# Optimizing lab procedures

## (Experimental Design)

**Generative AI can be used to create procedural templates and recommendations on best practices (e.g., reagents, equipment, techniques).**

### Issue/opportunity

Laboratory personnel, including researchers, technicians, and managers, often face challenges in maintaining up-to-date procedural templates and ensuring the consistent application of best practices, especially as scientific knowledge evolves rapidly. These challenges can lead to inefficiencies, errors, and inconsistency in experiments or analyses. Additionally, without a central source of curated recommendations, time and resources may be wasted sourcing and comparing various reagents, equipment, and techniques. These pain points present an opportunity for Generative AI to streamline and enhance laboratory processes.



## How Generative AI can help

### Generation of novel processes

Leveraging historical data and scientific principles, a Generative AI model could suggest novel experimental designs, more efficient processes, or alternate uses of reagents and equipment, stimulating innovation in laboratory procedures.

### Data analysis and interpretation

The Generative AI uses a large language model (LLM) to analyze data from lab protocols, equipment specifications, previous experimental designs, reagent usage, and techniques, providing a holistic understanding of laboratory procedures and principles.

# Optimizing lab procedures

## Managing risk and promoting trust



### Robust and reliable

The integration of multimodal text and images of complex structures and processes in experimental design presents complexity. This can heighten the risk of unworkable, unfeasible, or inefficient designs, as interpreting and accurately representing this diverse and intricate data can be challenging. These challenges could potentially lead to errors in the design and execution of experiments, resulting in failed or less reliable outcomes and unnecessary time and resource expenditure.



### Accountable

In the event of erroneous design recommendations, accountability may be an issue. Determining who bears the responsibility for incorrect designs and their potential consequences is important. The roles of human oversight and system validation need to be clearly defined.



### Explainable

With the application of AI in experimental design, there may be challenges related to explainability. If scientific or academic papers are to be published based on the results, authors need to be able to adequately explain the methodology behind the AI recommended designs, which can be inherently complex due to the black-box nature of some AI models.

## Potential benefits

### Efficiency

LLMs can reduce the time and effort needed for experimental design by streamlining and accelerating the data analysis, procedure consolidation and providing immediate best-practice recommendations.

### Lower cost

With less time required for experimental design, organizations can reduce the overall operational costs of experiments while also increasing their throughput.



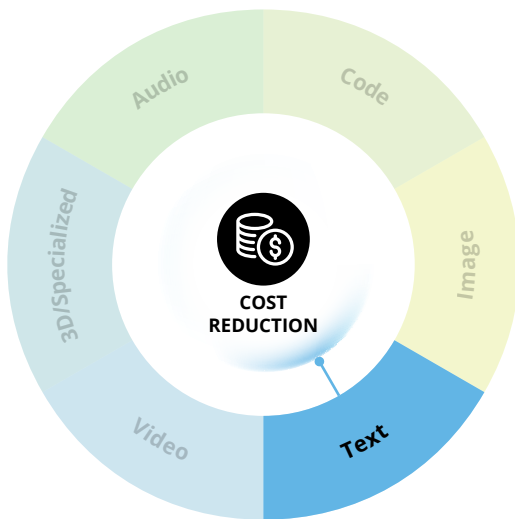
# Revealing the rules

## (Automated Regulatory Compliance)

**Generative AI can be used to support and enhance compliance by processing large amounts of regulatory documents from multiple geographies.**

### Issue/opportunity

Compliance to ever-changing regulations in every geography is a costly, time-consuming process for pharmaceutical companies. Even with significant investment in legal help, regulatory compliance can be hard to achieve. Regardless of the attempt, the fines associated with non-compliance are high.



## How Generative AI can help

### Text processing

Generative AI can be used to extract regulations for one specific purpose from thousands of pages of regulatory texts, expediting and enabling compliance.

### Transforming the legal support ecosystem

As Generative AI handles the laborious, detail-oriented process of regulatory text processing, it can also lead to a commensurate decrease in the need for third-party legal and compliance support.

### Mitigating financial risk

By employing Generative AI in regulatory compliance, the potential financial risk associated with non-compliance can be significantly reduced.



# Revealing the rules

## Managing risk and promoting trust



### Explainable

Generative AI models may produce outputs that are difficult to interpret, making it difficult to validate the outputs and explain the reasoning to regulatory authorities.



### Privacy

While regulatory authorities may vary, data privacy around personal health information remains a priority, and data that is not anonymized first may leak and become inappropriately disclosed.



### Reliable

A Generative AI model trained to extract compliance factors from regulatory documents may be susceptible to outputting information that looks accurate but is a hallucination, making human validation an important element for mitigating risks around reliability.

## Potential benefits

### Cost reduction

Using Generative AI to process regulatory documents reduces the need for humans to perform time-consuming tasks, thus lowering the cost of compliance.

### Fuel for growth

When regulatory compliance becomes tractable across geographies because of Generative AI processing capabilities, it helps the organization confidently expand business operations globally.



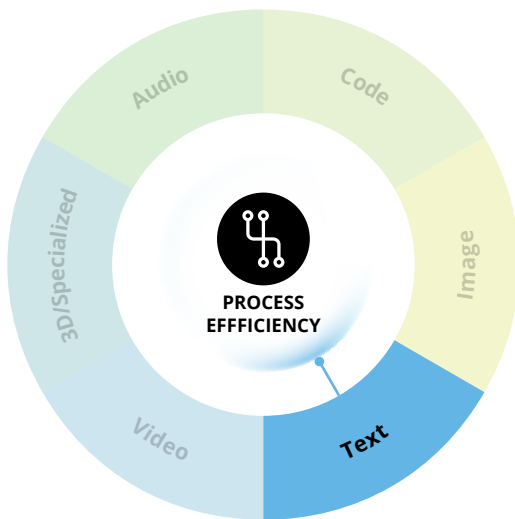
# Toward a superior supply chain

## (Demand Forecasting & Price Optimization)

**Generative AI can be used to reach across datasets related to supply chain management, helping increase precision in supply and demand forecasts.**

### Issue/opportunity

A variety of factors frustrate pharmaceutical company efforts to optimize their supply chain and better meet market demand. A shortage of product can lead to negative health implications for patients, while transport delays or overstocking for perishables can hamper gains in the margin. Meanwhile, geographical disparities between disease prevalence are difficult to analyze and manage. All this comes in the context of traditional supply chain management issues like weather, traffic patterns, warehousing costs, and the need to discard expired medicines.



## How Generative AI can help

### Precision in demand forecasting

Generative AI, employing advanced machine learning algorithms, can greatly enhance supply-demand balance. By ingesting and analyzing data from diverse sources (e.g., finance, procurement), the model can generate nuanced forecasts. This cross-silo data utilization leverages deep learning capabilities to identify patterns and trends that could be missed using traditional methods, thus mitigating the risk of product shortages.

### Localized forecasting

Generative AI's ability to incorporate multiple variables and local context factors takes forecasting to a new level. The model can integrate local geographical characteristics and disease prevalence data, along with socio-economic and logistical factors, to generate highly accurate, micromarket-specific demand forecasts. This is possible due to the system's contextual learning capability, which allows it to understand and learn from complex environments and situations.

# Toward a superior supply chain

## Managing risk and promoting trust



### Reliable

Generative AI's outputs, while increasingly accurate, should be subjected to human validation to ensure risk mitigation. Despite the AI's advanced capabilities, there's a need for human oversight to avoid potential errors, ensuring that the AI's recommendations align with real-world constraints.



### Explainable

To trust the model, supply chain managers need to understand how it calculated demand and supply estimates. Clear, interpretable outputs make AI-driven decisions more transparent, fostering trust and facilitating wider adoption of these advanced technologies in supply chain operations.

## Potential benefits

### Moving towards net-zero

The precision and efficiency brought about by Generative AI can significantly contribute to an organization's sustainability goals. It minimizes waste and reduces carbon footprint by avoiding overproduction and unnecessary transportation, which is achieved through the AI's optimization capabilities that efficiently align demand with supply.

### Efficiency drives gains

The implementation of Generative AI can lead to lower prices for patients, increased revenue for enterprises, and cascading financial benefits for insurers and governments. This is possible due to the AI's capability to create optimized, cost-effective supply chain strategies, which result in resource savings and enhanced profitability.



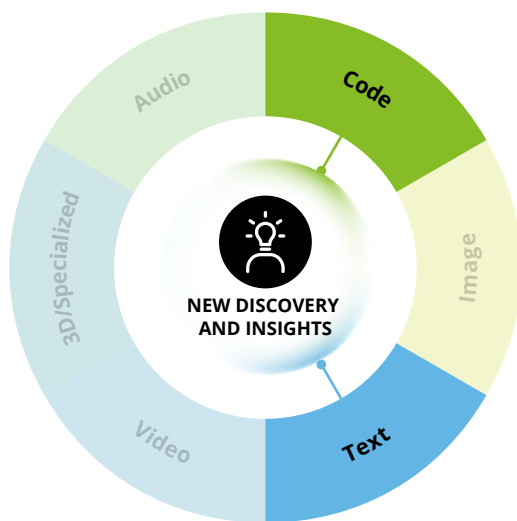
# Smarter clinical trials

## (Conducting clinical trials that mirror real-world populations)

**AI can improve the accuracy and effectiveness of clinical trials by quickly identifying and addressing misalignments between sample patient pools and real-world patient populations.**

### Issue/opportunity

Clinical trials often rely on narrow patient pools that do not fully reflect the broader population's genetic, environmental, and lifestyle variations. A limited participant base can lead to incomplete and inaccurate data on how treatments work for different types of individuals. In particular, some patients might experience variations in drug efficacy and safety that go unnoticed in smaller, homogenous groups. Broader participation can help ensure treatments are applicable to as many people as possible.



## How Generative AI can help

### Identify sample population gaps

Generative AI can be used to analyze legacy and ongoing clinical trial data against external benchmarks (such as national census demographics) to identify underrepresented populations.

### Address gaps in real time

An AI-powered dashboard can track recruitment by demographic group and provide automatic alerts when gaps emerge, along with suggestions on how to address them (e.g., outreach strategies, alternative trial sites, or digital engagement solutions).

# Smarter clinical trials

## Managing risk and promoting trust



### Fair and impartial

AI models should be trained and validated using demographically broad datasets to avoid systemic bias in recruitment strategies. Representation audits can help ensure no population segments are inadvertently favored or excluded.



### Respectful of privacy

All patient data used in training or analysis should be anonymized and managed according to HIPAA, GDPR, and local data protection regulations. AI tools can be designed to work with de-identified datasets.



### Robust and reliable

Models should be stress-tested across multiple trial scenarios and geographies to ensure consistent performance. A human-in-the-loop approach can validate AI-driven recommendations.

## Potential benefits

### More accurate trial results

By including a broader and more demographically representative participant pool, clinical trials are more likely to produce results that reflect the real-world effectiveness of a drug across different populations.

### Faster and more cost-effective trials

AI can facilitate many aspects of the clinical trial process—including patient identification, recruitment tracking, and early identification of enrollment gaps. This allows trials to proceed more quickly and efficiently, reducing the overall time and cost to bring new therapies to market.

### Regulatory and market readiness

Clinical trials that accurately reflect target patient populations increase the credibility and relevance of results in real-world settings, which can enable faster regulatory approval and smoother market entry.

### Better commercial outcomes

Drugs that are tested and proven effective across a wide range of demographic groups are more likely to gain broad clinical adoption, which increases their commercial potential.



# 20/20 impurity detection

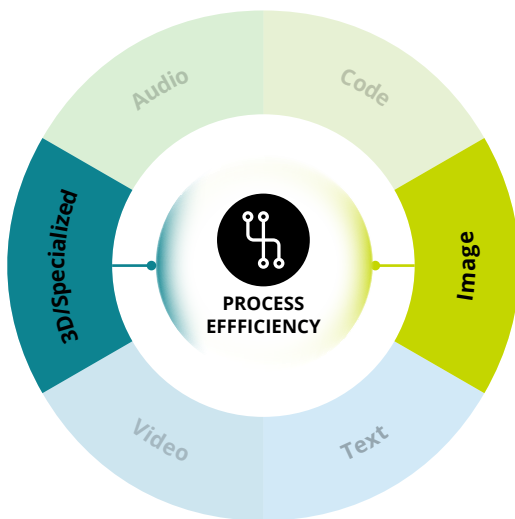
## (AI-driven visual inspection for particulate matter in IV fluids)

**Computer vision powered by AI can be used to detect particulate contamination in IV bags, reducing product waste and improving patient safety in life sciences manufacturing.**

### Issue/opportunity

Pharmaceutical manufacturers, particularly those producing IV fluids and life-saving therapies, face a persistent and costly challenge: detecting particulate matter in sterile products. Despite sterile manufacturing environments, small particles—such as plastic, dust, or other foreign materials—can still enter IV bags, posing serious health risks to patients.

This issue is not new—dating back to the 1940s—and despite ongoing improvements, a scalable, reliable, and cost-efficient solution has remained elusive. Historically, detection has relied on manual inspection, often using contingent labor, leading to inconsistent results, high labor costs, and significant product waste. Also, every incident of contamination risks brand reputation, regulatory scrutiny, and potential product recalls.



## How Generative AI can help

### Automated, real-time inspection

By combining AI vision capabilities with GenAI models trained on synthetic and real-world data, manufacturers can automate the inspection process at scale. High-resolution imaging and computer vision detect anomalies in fluid packaging with greater precision and consistency than the human eye. Also, unlike human inspectors, AI does not experience distractions and fatigue.

### Continuous learning

GenAI enhances the system by learning from historical defect data, adapting to new defect types, and identifying potential causes through pattern recognition across vast datasets. The AI system not only flags potential contamination in real time but also enables traceability—helping identify the root cause by analyzing patterns across manufacturing lines, geographies, or specific production lots. This insight enables proactive correction and long-term process improvements.



# 20/20 impurity detection

## Managing risk and promoting trust



### Robust and reliable

AI models should undergo rigorous testing across multiple manufacturing lines and environments to ensure high accuracy and minimal false positives/negatives. Redundancy checks, human-in-the-loop validation, and performance monitoring help ensure reliable operation even under variable lighting or packaging conditions.



### Transparent and explainable

AI-based contamination detection can provide clear, trackable results, allowing manufacturers to understand why a product passes or fails inspection. Detailed imaging and reporting help ensure accountability and regulatory compliance while enhancing confidence in quality control.

## Potential benefits

### Improved patient safety and confidence

Consistent detection of contaminants before they enter the supply chain increases patient safety, and fewer quality incidents enhance brand trust with hospitals, regulators, and patients.

### Operational efficiency and scalability

Replacing manual inspection with AI reduces reliance on contingent labor and speeds up quality control processes. Also, AI-based solutions can be deployed at scale across multiple products, manufacturing lines, and facilities worldwide.

### Improved ROI and reduced costs/waste

AI helps drive measurable ROI through improved efficiency, reduced labor costs, and avoidance of costly recalls. Also, fewer discarded bags due to false positives or late-stage detection leads to significant material savings.

### Quality and traceability

Root cause analysis helps address upstream issues in the manufacturing line, improving overall process quality.



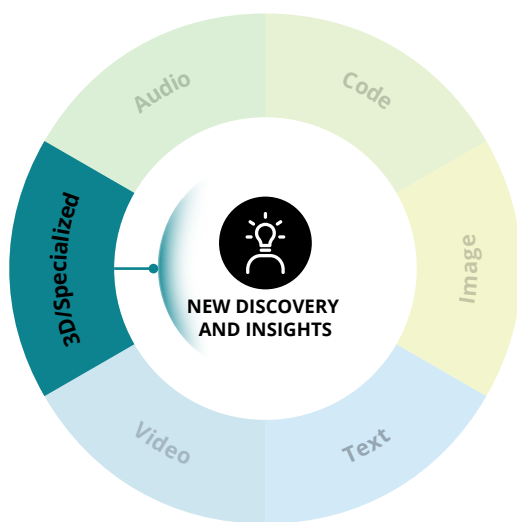
# Accelerated drug discovery

**(Creating new drugs by proposing and evaluating modifications to existing molecules)**

**Pharmaceutical companies are enhancing and accelerating early-stage drug development by using AI systems that can propose structural modifications to known molecules and then evaluate their therapeutic potential and feasibility.**

## Issue/opportunity

Drug discovery is a highly iterative, slow, and resource-intensive process. Medicinal chemists, constrained by human brainpower and timelines, can only explore a narrow slice of the chemical space when optimizing molecules for properties such as potency and safety. Also, traditional workflows lack scalability and make it difficult to consistently identify and prioritize high-quality drug candidates.



## How Generative AI can help

### Proposing modifications to existing molecules

AI can propose modifications to known starting molecules, mimicking how medicinal chemists work but at exponentially greater scale. These modifications are not random; they are guided by predictive models for key drug properties such as efficacy, absorption, metabolism, and synthesizability.

### Prioritizing new drug candidates

An optimization layer can evaluate and prioritize candidates based on how well they satisfy various requirements and constraints. The process is automated and systematic, allowing chemists to triage and refine ideas faster, while retaining human oversight.

# Accelerated drug discovery

## Managing risk and promoting trust



### Robust and reliable

Focusing on modifying known molecules rather than generating new molecules from scratch can help avoid hallucinations. Also, all AI models should undergo rigorous internal testing and version control before being deployed. Performance can be benchmarked against historical chemist-designed molecules, and the system should only be scaled after demonstrating consistent value across multiple projects with defined constraints and inputs.



### Transparent and explainable

Rather than operating as a black box, the system can present a ranked list of AI-generated molecule suggestions accompanied by the underlying rationale and predicted property scores.



### Responsible and accountable

Medicinal chemists should remain in the loop, retaining veto power over each decision, which helps build trust and limit risk.

## Potential benefits

### Three- to fivefold acceleration in early discovery

AI can enable rapid iteration and faster decision-making by generating and evaluating viable molecule candidates in weeks rather than months or years.

### Higher-quality molecules at lower cost

Use of AI can help chemists identify and prioritize drug candidates that most effectively satisfy multiple property constraints, raising the bar for what progresses to later stages. By homing in quickly on promising candidates and flagging unviable ones early, the system can reduce aggregate drug development costs.

### Improved productivity

By automatically triaging and filtering candidates, AI can enable development teams to work on more programs simultaneously.

# Conclusion

## Getting the most value from Generative AI

These are the early days of Generative AI, but the technology is rapidly maturing. As it does, organizations in every industry will probe how this type of AI can contribute to their business and open doors to transformative opportunities. As such, an important part of understanding and working with Generative AI is shaping the vision for the future, acknowledging both the potential benefits and the risks.

In this Generative AI-enabled era, governance and risk mitigation are business imperatives. The challenges organizations face with traditional AI are amplified in this new arena. A commitment to the trustworthy development and use of Generative AI will only become more important as the capabilities grow and governing bodies shape rules for their application.

Still, there is also a risk in waiting to embrace Generative AI. The use cases described in this dossier are a starting point for exploring how this powerful technology can be used to improve the enterprise today and prepare it to lead in the future.



**Beena Ammanath**  
Global Deloitte AI Institute  
Leader, Deloitte AI Institute  
United States, Lead  
Deloitte Consulting LLP

A handwritten signature in blue ink, reading "Beena".



**Francisco Barroso**  
Global Generative AI Market  
Activation Leader  
Deloitte Consulting LLP

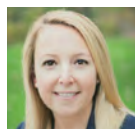
A handwritten signature in black ink, reading "Francisco".



**Sulabh Soral**  
Deloitte AI Institute  
United Kingdom, Lead  
Deloitte United Kingdom

A handwritten signature in black ink, reading "Sulabh".

# Contact us



**Kate Schmidt**  
**US Deloitte AI Institute Leader**  
Deloitte Consulting LLP  
kateschmidt@deloitte.com



**Ivana Savic Vucenovic**  
**Global Office of Generative AI Program Leader**  
Deloitte Touche Tohmatsu  
ivucenovic@deloitte.com



**Beena Ammanath**  
**Global Deloitte AI Institute Leader, Deloitte AI Institute United States, Lead**  
Deloitte Consulting LLP  
bammanath@deloitte.com



**Audrey Ancion**  
**Deloitte AI Institute Canada, Lead**  
Deloitte Canada  
knuttall@deloitte.com



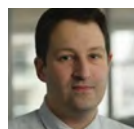
**Naser Bakhshi**  
**Deloitte AI Institute Netherlands, Lead**  
Deloitte Netherlands  
nbakhshi@deloitte.nl



**Yousef Barkawie**  
**Deloitte AI Institute Middle East, Lead**  
Deloitte United Arab Emirates  
ybarkawie@deloitte.com



**Dr. Bjoern Bringmann**  
**Deloitte AI Institute Germany, Lead**  
Deloitte Germany  
bbringmann@deloitte.com



**Jefferson Denti**  
**Deloitte AI Institute Brazil, Lead**  
Deloitte Brazil  
jdenti@deloitte.com



**Tiago Durao**  
**Deloitte AI Institute Portugal, Lead**  
Deloitte Portugal  
tdurao@deloitte.com



**Roman Fan**  
**Deloitte AI Institute China, Lead**  
Deloitte China  
rfan@deloitte.com



**Nicolas Griedlich**  
**Deloitte AI Institute Luxembourg, Lead**  
Deloitte Luxembourg  
ngriedlich@deloitte.lu



**Jan Hejtmanek**  
**Deloitte AI Institute Central Europe, Lead**  
Deloitte Central Europe  
jhejtmanek@deloitte.com



**Prashanth Kaddi**  
**Deloitte AI Institute India, Lead**  
Deloitte India  
pkaddi@deloitte.com



**Chris Lewin**  
**Deloitte AI Institute Asia Pacific Lead**  
Deloitte Singapore  
chrislewin@deloitte.com



**Tomotake Koza**  
**Deloitte AI Institute Japan, Lead**  
Deloitte Japan  
tomotake.koza@tohmatsu.co.jp



**Dr. Kellie Nuttall**  
**Deloitte AI Institute Australia, Lead**  
Deloitte Australia  
knuttall@deloitte.com



**Wessel Oosthuizen**  
**Deloitte AI Institute Africa, Lead**  
Deloitte Africa  
woosthuizen@deloitte.com



**Sulabh Soral**  
**Deloitte AI Institute United Kingdom, Lead**  
Deloitte United Kingdom  
ssoral@deloitte.com



**Richard Eudes**  
**Deloitte AI Institute France, Lead**  
Deloitte France  
reudes@deloitte.fr



**Philipp Wendland**  
**Deloitte AI Institute Germany, Program Manager**  
Deloitte Germany  
pwendland@deloitte.com

# Endnotes

1. Rick Childs, Tony Rinkenberger, and Carmen Sessoms, "The Denials Challenge: A Cross-functional Approach to Denial Prevention and Management," Change Healthcare, October 2017. [www.beckershospitalreview.com/pdfs/Change%20HC\\_Webinar%20Slides\\_Nov17.pdf](http://www.beckershospitalreview.com/pdfs/Change%20HC_Webinar%20Slides_Nov17.pdf)
2. Tai-Seale M, Olson CW, Li J, Chan AS, Morikawa C, Durbin M, Wang W, Luft HS. Electronic Health Record Logs Indicate That Physicians Split Time Evenly Between Seeing Patients And Desktop Medicine. Health Aff (Millwood). 2017 Apr 1;36(4):655-662. doi: 10.1377/hlthaff.2016.0811. PMID: 28373331; PMCID: PMC5546411. <https://pubmed.ncbi.nlm.nih.gov/28373331/>





This communication contains general information only, and none of Deloitte Touche Tohmatsu Limited, its member firms, or their related entities (collectively, the “Deloitte Network”) is, by means of this communication, rendering professional advice or services. Before making any decision or taking any action that may affect your finances or your business, you should consult a qualified professional adviser. No entity in the Deloitte Network shall be responsible for any loss whatsoever sustained by any person who relies on this communication.

#### **About Deloitte**

Deloitte refers to one or more of Deloitte Touche Tohmatsu Limited, a UK private company limited by guarantee (“DTTL”), its network of member firms, and their related entities. DTTL and each of its member firms are legally separate and independent entities. DTTL (also referred to as “Deloitte Global”) does not provide services to clients. In the United States, Deloitte refers to one or more of the US member firms of DTTL, their related entities that operate using the “Deloitte” name in the United States and their respective affiliates. Certain services may not be available to attest clients under the rules and regulations of public accounting. Please see [www.deloitte.com/about](http://www.deloitte.com/about) to learn more about our global network of member firms.