

REDESIGN HEALTH

AI/ML Considerations for Seed Stage Ventures



Guide for RH CEO's



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This is intended to be an educational resource for the types of artificial intelligence that exist and possible vendors of such technology. Before purchasing and implementing any AI models, you should work with legal counsel (i.e. Redesign Health Legal, Policy and Compliance team, if within bounded engagement or outside counsel, if outside of the bounded engagement) to review the relevant terms and conditions of such vendor.









Four AI Questions to Consider for New Concepts



- Given the large amount of interest in AI/ML across the digital health space we are seeing a large volume of requests to incorporate AI/ML into new launches for RH Opco's
- As you consider the role of AI/ML in your new venture it is helpful to consider these 4 Key Questions:
 - Which AI business models are on-strategy for your venture?
 - What are the best uses cases for AI within your venture?
 - Which AI technology is relevant to your venture?
 - What is the right launch cadence for AI in your product roadmap?

1 Which AI Business Models are On-Strategy for your venture?







AI Infrastructure Provider	Foundational Model Developer	Application Layer	End-Users
Sells technologies for the creation of Foundational Models	Trains and hosts Foundational Models which are the underlying AI layer	Further Trains Foundational Models on specific vertical applications <i>(Some of these companies work with proprietary models)</i>	Uses AI for specific tasks
  HUGGING FACE	 OpenAI  ANTHROPIC	 abridge  MEMORA HEALTH	 doximity  Epic

- **Infrastructure Providers** may be the only players that actually capture value as the middle portions of the AI value chain become commoditized. These are tech-heavy ventures that do not appear to have a vertical (i.e. healthcare specific) play.
- Creation of **Foundational Models** is a compute-heavy expensive pursuit. They may become commoditized if performance levels converge over time.
- **Application Layer** companies can be built by training 3rd party models with proprietary data sets (product moat). They are exposed to graduation risk -i.e. that the Foundational Model provider will extend into their space.
- Most of RH's companies will be **End-users** of AI through API interfaces to Foundational and Application Layer players. They need to be able to create incremental value over the API call costs of AI (which appear to be falling w/scale up).

2 What are the Best Uses Cases for AI within your concept?



 Administrative Workflow	 Clinical Encounter & Decision Support	 User or Patient Engagement	 BI & Analytics
<ul style="list-style-type: none"> • Capture physician charge data • Generate billing code data • Pre-Auth automation (Infinx, Ethermed, Olive) • Generate denials/appeals letters (Doximity) • UM Nurse workflow automation • Automated RAF scoring / HCC Risk Adjustment (Apixio, Optum) 	<ul style="list-style-type: none"> • Ambient Listening for Patient Encounters (Microsoft, Suki) • Generation of patient note (Abridge) • Writing a care plan • Flagging of at risk patients (Bayesian Health) • Review provider data set and generate customized care guidelines (Atropos) • Automated abstraction / metatagging of clinical data (Mendel.AI) • Medical training & education 	<ul style="list-style-type: none"> • General Healthcare Search • Patient engagement (Memora) • Customer support (Moveworks) • Insurance enrollment assistance • Physician or Provider selection assistance 	<ul style="list-style-type: none"> • Payor contract comparisons for VBC • Provider performance monitoring • Population Health based recommendations (Certilytics)

Use cases in green are commercially available (Vendor)

For Tech Enabled Service Ventures

- Clinical Encounter / Decision Support AI as well as Workflow AI can make clinical staff more efficient
- User & Patient Engagement AI can help the venture scale with limited resources
- More likely to be licensing 3rd party AI and focusing on care delivery



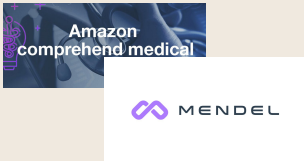
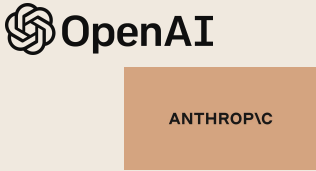

For SaaS Ventures

- Clinical workflows offered by the SaaS platform can benefit from automation steps covered in Workflow and Clinical Decision Support AI
- Administrative workflows can benefit from Workflow AI automations and BI/Analytics layers that inform the user
- Can license 3rd party AI but also more likely to train their own models to support their SaaS price point

3 Which AI technology is relevant to your concept?



Deep Learning Commonly Utilized

Rules Based Engines	Robotic Process Automation (RPA)	Natural Language Understanding (NLU: subset of NLP)	Natural Language Generation (NLG: subset of NLP)	Computer Vision
<ul style="list-style-type: none"> Use of algorithms and rules logic to automate decisions Not technically AI but often marketed as such Does not require training models 	<ul style="list-style-type: none"> Automations and bots that have been trained to complete workflow tasks usually done by a human Often referred to as “screen scrapers” 	<ul style="list-style-type: none"> AI applied to reading and understanding language Parses script and can tag it Backbone for products like Alexa and Siri when combined with voice recognition and voice generation 	<ul style="list-style-type: none"> AI model that can generate text and images Transformer technology (2017) and Large Language Models helped created Generative Pre-Transformer 3 (GPT-3) 	<ul style="list-style-type: none"> AI applied to reading images Has been applied to the radiology and pathology spaces FDA approved applications exist in this space
				

- Simpler technology (i.e. Rules Based Engines, RPA) does not require training a black-box machine learning model and can be easier to deploy (but less differentiated and performant)
- Most vendors integrate their technology through API calls or their own web app
- Variety of cost models exist including (1) per word/token pricing, (2) annual subscription fee, (3) case/volume pricing

4 | What is the right launch cadence for AI in your product roadmap?



AI Deployment at MVP

- Creation of an ML model requires data sets, model training, and can be costly
 - To Date, Anomaly is the only RH company that has deployed an ML model at initial launch
 - If ML model development is required at MVP then paring down scope (i.e. initial disease state focus) can accelerate training
- **The deployment of rules-based engines is easier and cheaper to do for an MVP**
- API based AI models like ChatGPT can be deployed if budgets permit (API Call Charges)

AI Deployment in Years 1-2

- Once a user workflow has been launched it can easier to seat AI within that workflow post-launch
- Data can be purchased to train in-house models for job steps where AI holds the most potential
- Third Party models will grow in volume and can be seated into the workflow utilizing API integrations

AI Deployment from Year 3 Onwards

- Many tech-enabled services ventures will have acquired enough in-house user data to train ML models by this point

Appendix



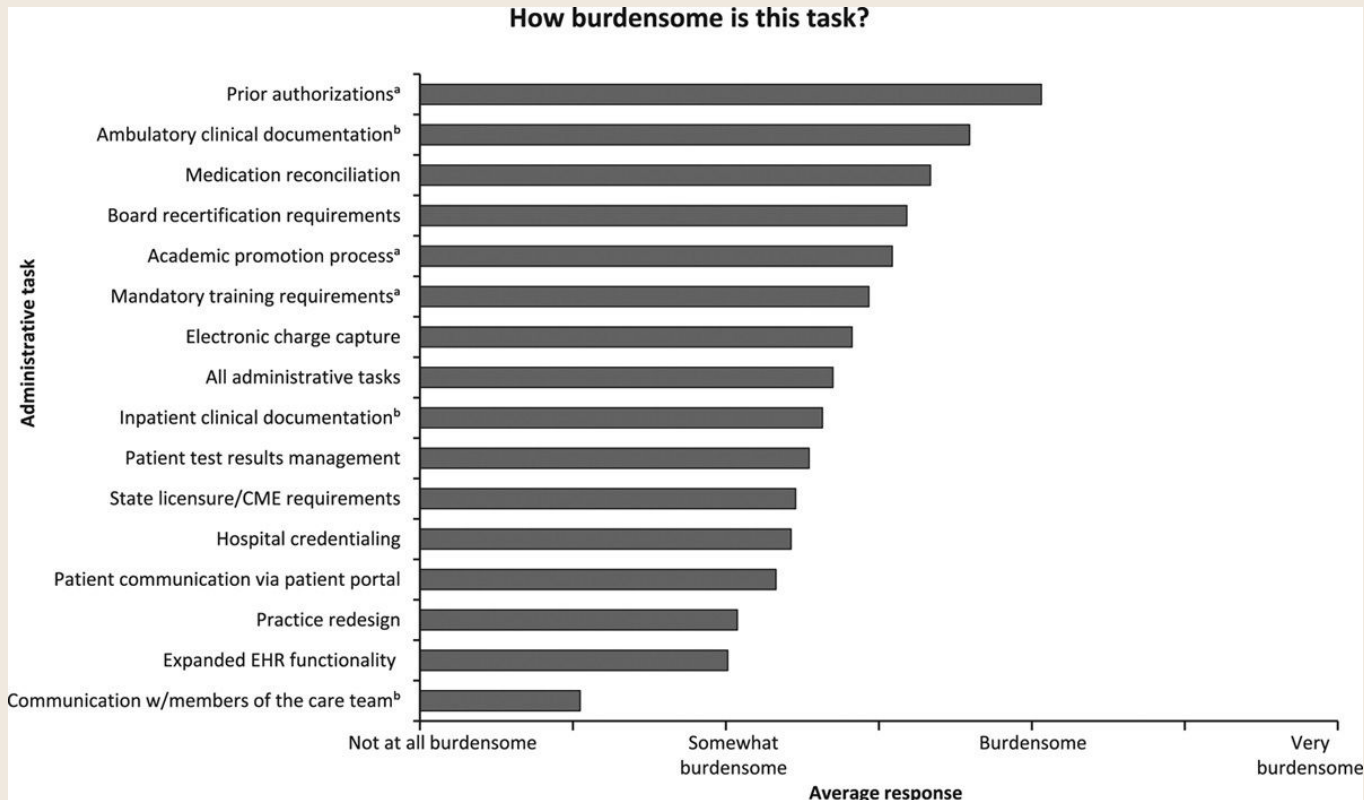
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Market Feedback on AI/ML Feature Scope





Administrative Burdens in Healthcare



Source: Paulius Mui and Ben Lee, AI has entered the Chat, April 20th

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Planning for AI Development: Cost and Labor





Financial Modeling and AI

Costs of Launching AI Functionality depend on whether it rests on **In-House Development** or **3rd Party Utilization**

Data Acquisition Costs (In-House Development)

- For clinical work patient data sets can be acquired on a per patient case rate
- IQVIA and other data vendors work in this space
- Datavant sells de-identification / tokenization tech

Model Costs (In-House Development)

- Many open source free models exist (BERT from Google)
- Some models (ChatGPT) are proprietary and can only be used on API call cost basis

Data Science / Training Costs (In-House Development)

- Data science teams can be hired as FTE's or used through consulting firms
- Data annotation may be needed for in-house model development
- Models are trained in training runs and then evaluated with tests sets. It may take months or years to train a model to reach the accuracy level needed.

Engineering / Deployment Costs (In-House Development and 3rd Party Utilization)

- Engineering team is needed to productionize any AI system with front end / back end / devops development

API Call Costs (3rd Party Utilization)

- Most foundational models work off a menu of API call costs
- Open AI pricing is [here](#) and has fallen in the past as they have scaled up their utilization



Team Roles in AI Development

There are a variety of individuals you can hire or contract with for AI Development

Product Managers (For both In-House Development and 3rd Party Models)

- Focused on the user experience, value prop, overall product strategy, and overall roadmap that can include AI features
- Use customer insights data to provide direction to the Engineering team on the choice of project to pursue

Data Scientists (Especially For In-House Development)

- Engineering role most responsible for the creation of new AI functionality
- Skilled in matching the right AI model to use case and running experiments to train AI models
- Can usually code in Python, R, and other AI/ML related languages

Full Stack Engineers (For both In-House Development and 3rd Party Models)

- Engineers that can code both the front end experience and back end database systems that power an AI experience
- Will touch the product surface area around the AI model

Data Engineers (For both In-House Development and 3rd Party Models)

- Engineers skilled at back-end data pipeline development to integrate data from different source systems across organizations
- Data collection, storage, curation and performing the transformations necessary to prepare data for ML training and testing
- Architect, build and performance tune scalable infrastructures required to train ML models and deploy to production systems

UX Design (For In-House Development)

- Develop the user experience through which the AI model is utilized
- Some AI companies have utilized avatars or personalization to embody the AI to the User

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

Using an LLM for a new feature





Launching a new feature with an LLM

If you plan to use an LLM for a new feature release here are the steps you should consider

 Demand Validation	 LLM Selection and Cost Forecasting	 LLM Data Integration	 Final Eng Work and Feature Release
<ul style="list-style-type: none">Qualitative or quantitative market research can validate the demand and workflow for releaseThings to ask:<ul style="list-style-type: none">What step of the workflow does the user want to automate or augment?What kind of output does the user want? Written text? Rating? Prioritization?What is the desired context for receiving the output? In workflow? Email?What is their willingness-to-pay for the new feature?	<ul style="list-style-type: none">Multiple LLM's exist on the market with ChatGPT being the most widely discussedSelection consideration<ul style="list-style-type: none">For a user-facing use case with chat functionality Open AI may be easierCost Forecasting<ul style="list-style-type: none">Most foundational models publish their API call cost menu	<ul style="list-style-type: none">API interfaces can be integrated to allow for bi-directional data sharingInfosec and legal/compliance concerns should be reviewed at this phaseModel Performance testing should be done to ensure that the LLM is performing well in the desired use caseData latency should be assessed to ensure the output does not slow down the user	<ul style="list-style-type: none">The End-User experience or web app where the AI interface resides is developed<ul style="list-style-type: none">Deploying a model in workflow is a key to adoptionPre-set Prompts may be helpful for the user experienceUser Acceptance Testing is important to validate the deployed experience
<i>Budget 1 month and small qual research budget at minimum</i>	<i>Budget 1 month</i>	<i>Budget 1-2 months and associated engineering cost</i>	<i>Budget 2-3 months and associated engineering cost</i>

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Application of LLM Models – Cost Estimates





Healthcare LLM OpCos

A day in the life of Patient-facing LLMCo

AI backend cost estimate (*)

- Fine-tuning: \$120k / 1B words (would include rounding & patient profile data as input)
- Generation: ~\$5 per care plan

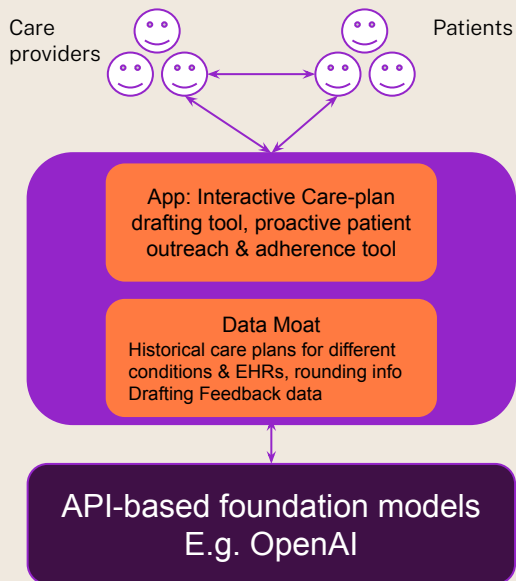
Other costs:

- Small (3-5 pp) AI eng team
- Small (2-4 pp) app dev team
- Proactive messaging tools / partnerships / integrations

Risks:

- Incorrect care plan not noticed by providers → can be dangerous

(*) Example Pricing Structure



write a care plan for a patient just diagnosed with early-stage rheumatoid arthritis

Patient Information: (Name, Age, Gender, Chief Complaint)

Care Plan for: (Patient Name)

Diagnosis: Early-stage Rheumatoid Arthritis

Date of Care Plan: (Current Date)

Assessment:

- * Patient has been diagnosed with early-stage Rheumatoid Arthritis (RA) and reports joint pain, stiffness, and swelling.
- * Joints affected include hands, feet, and knees.
- * Patient reports fatigue, low-grade fever, and loss of appetite.

Goals:

1. Relieve joint pain and swelling
2. Improve joint mobility and function
3. Reduce inflammation
4. Improve overall well-being and quality of life

Interventions:

1. Medications: Prescribe non-steroidal anti-inflammatory drugs (NSAIDs) such as ibuprofen or naproxen to relieve pain and reduce inflammation. If necessary, the physician may also prescribe disease-modifying anti-rheumatic drugs (DMARDs) such as methotrexate to slow the progression of the disease.
2. Physical Therapy: Refer the patient to a physical therapist to develop an exercise program to maintain joint mobility, flexibility, and strength.
3. Assistive Devices: Recommend the use of assistive devices such as canes or splints to help with joint pain and stability.
4. Heat/Cold Therapy: Teach the patient to use heat or cold therapy to relieve joint pain and swelling.
5. Healthy Lifestyle: Encourage the patient to maintain a healthy diet and engage in regular physical activity to maintain a healthy weight and reduce stress on affected joints.
6. Monitoring: Regular monitoring of disease progression, medication effectiveness, and potential side effects.



Healthcare LLM OpCos

A day in the life of Provider LLMCo

AI backend cost estimate (*)

- Fine-tuning: \$120k / 1B words (would include ingesting of plan docs)
- Generation: ~\$5 per care plan

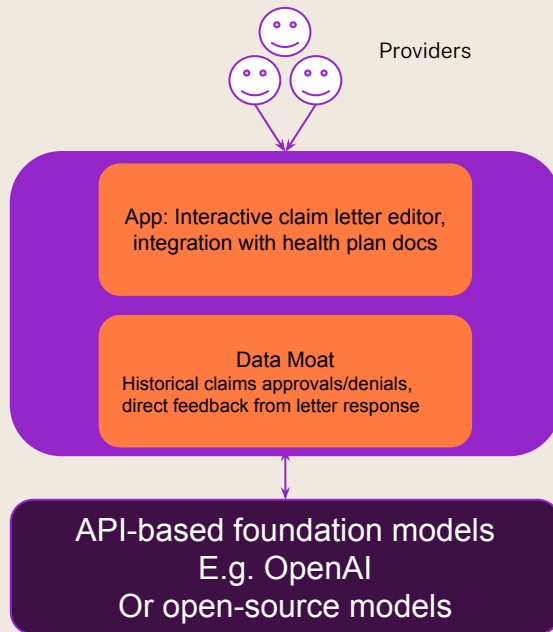
Other costs:

- Small AI eng team
- Small front-end team

Risks:

- References & reasoning can be false / fake → can lead to delays

(*) Example Pricing Structure



Write a letter to United Healthcare asking them to approve an Echocardiogram on a patient with systemic sclerosis. Make references to the appropriate literature and list the articles.



Dear United Healthcare,



I am writing this letter on behalf of one of my patients who is suffering from systemic sclerosis. I am requesting that you approve an Echocardiogram for this patient as it is crucial for proper diagnosis and treatment.

Systemic sclerosis, also known as scleroderma, is a chronic autoimmune disease that can affect multiple organ systems, including the heart. According to recent studies, echocardiography is an essential tool in the evaluation of patients with systemic sclerosis and can help identify early signs of cardiac involvement.

One such study, published in the European Journal of Echocardiography, found that echocardiography can detect subclinical cardiac involvement in patients with systemic sclerosis, which is not always evident on clinical examination. Another study, published in the Annals of the Rheumatic Diseases, showed that early detection and monitoring of cardiac involvement in systemic sclerosis patients using echocardiography can lead to improved outcomes and reduced morbidity.

I strongly believe that an Echocardiogram is necessary for my patient, who has been suffering from systemic sclerosis for several years, to properly assess the status of their heart and monitor any potential changes in their condition. I have attached copies of the above-mentioned studies for your review.

I appreciate your time and consideration in this matter. I hope that you will approve the requested Echocardiogram for my patient so that they can receive the proper care and treatment they need.

Sincerely,
[Your Name]

References:

1. European Journal of Echocardiography: "Detection of subclinical cardiac involvement in systemic sclerosis by echocardiography"
2. Annals of the Rheumatic Diseases: "Early detection and monitoring of cardiac involvement in systemic sclerosis: the role of echocardiography"



Healthcare LLM OpCos

A day in the life of Payer LLMCo

AI backend cost estimate (*)

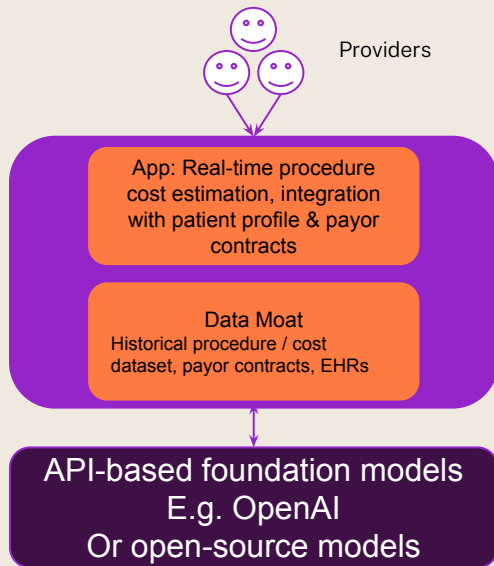
- Fine-tuning: \$120k / 1B words (would include ingesting of plan docs)
- Calculation cost: ~\$0.02 per calculation

Other costs:

- Medium (5-10pp) AI eng team
 - ChatGPT “hedges” its answer
- Small front-end team
- Payment system integration

Risks:

- Estimation can have large errors → poor patient experience



estimate the cost of knee replacement surgery for a patient who is 35 years old, covered by Medicare Advantage

The cost of knee replacement surgery for a patient covered by Medicare Advantage can vary depending on a number of factors, including the type of procedure, the location of the hospital, and the patient's individual health circumstances. On average, a knee replacement surgery can cost anywhere from \$20,000 to \$60,000, although the exact cost will depend on the patient's specific needs.

Medicare Advantage plans are offered by private insurance companies that contract with Medicare to provide Medicare benefits to beneficiaries. The cost of a knee replacement surgery under a Medicare Advantage plan will depend on the specific terms and conditions of the plan, such as the patient's deductible, copayments, and coinsurance amounts.

In general, Medicare Advantage plans typically cover a portion of the cost of knee replacement surgery, and the patient is responsible for paying the remaining out-of-pocket costs, including deductibles, copays, and coinsurance. It is recommended that patients check with their Medicare Advantage plan to determine their specific cost-sharing responsibilities and to get a better idea of the overall cost of their knee replacement surgery.



Applications of LLMs for Healthcare

Area	Status Quo	LLM Alternative	Data Required
<i>Appeals / Denials generation</i>	Manual letter writing	Auto-generate letters from similar claims	Historical claims and appeals letters
<i>EHR “in-filling”</i>	Many manual steps by doctors	Doctor gives high level summary/prompt and the details are auto-populated	Historical EHR records & in-house app “training data” for use with Reinforcement Learning
<i>Mobile Charge Capture</i>	Manually input charges from provider rounds	Automatically collect & input charge data	Inpatient rounding notes
<i>Medical Transcription</i>	High error rates	Potentially much lower error rates	Audio recordings
<i>Payer Network Contracts</i>	Contracts sit on a drive as docs / pdfs	UM decision QA system	Existing word docs / pdfs