

CLARIFYING ♥ CARE

EFFICIENT & EFFECTIVE DISCHARGE SUMMARIES



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Agenda

- Problem Statement & Why it Matters
- Product Demo & Evaluation
- Technical Design & Future Opportunities



Customer & Problem Background

Care Hospital
Beside Axis bank, Opp Kalyani Society, Kothrud, Pune - 411038.
Ph: 094233 80390, Timing: 09:00 AM - 02:00 PM, 03:30 PM - 7:00 PM | Closed: Thursday

DISCHARGE SUMMARY

Patient UID: 367
Name: P. SHREEDHAR (Male)
Address: PUNE

Admission No : 000063
Admission Date : 05-Jun-2022, 06:01
Discharge Date : 08-Jun-2022, 11:35
Discharge Status:
Discharged

Primary Treating Consultant's Details:
Dr. Onkar Bhawe
Specialty: Orthopedic Surgeon

Other Consultants:
Dr. C. Mohan (Anesthetist)

• **Provisional Diagnosis at the time of Admission:**
FRACTURE AT WRIST AND HAND LEVEL, [ICD-10 Code: S62]

• **Final Diagnosis at the time of Discharge:**
FRACTURE AT WRIST AND HAND LEVEL, [ICD-10 Code: S62]

• **Presenting Complaints with Duration and Reason for Admission:**
PAIN IN LEFT HAND
HAND INJURY

• **Key findings, on physical examination at the time of admission:**
- **Vital Signs:**
BP (mmHg): 122/80, Pulse (/min): 72

• **General Appearance:**
Head/Eyes/Nose/Throat/Neck, Heart, Chest/Lung, Abdomen, Skin, Extremities/Spine, Neurological
Examinations: NAD

• **Summary of key investigations during Hospitalization:**
X-RAY

• **Course in the Hospital including complications if any:**
HAND SURGERY PERFORMED

• **Treatment Given:**
INJECTION CABIULAXZ 560

• **Surgery Notes:**
1. Hand Reconstruction Surgery
Time : 06-06-2022, 11:21 AM, Duration : 1 HRS
Details : Hand Reconstruction Surgery Done Successfully
1. Patient consent: The surgery and its alternatives were discussed with the patient. Risks were

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Hospital Discharge Summary

- Your diagnosis
- What took place in the hospital
- Medications to take and follow-up care needed

Disliked by
Doctors



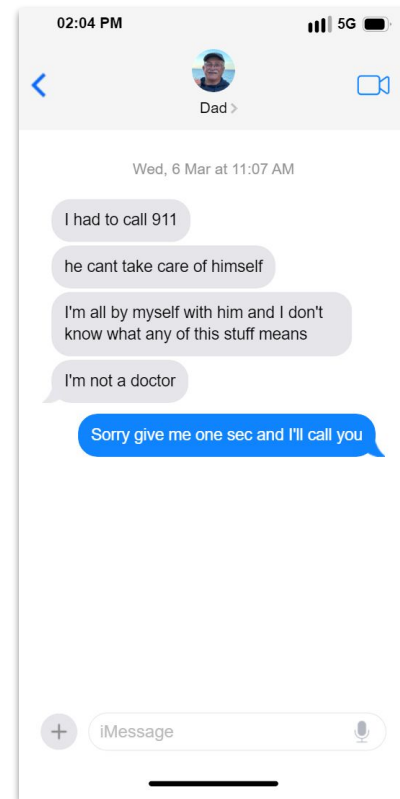
Disliked by
Patients





Why it Matters

- Over **33 million people** are admitted to the hospital each year in the US. A few weeks ago, **my uncle was one of them**.
- **Overwhelmed** by the discharge summary
 - Too long, too complicated, unclear follow-up care
- **Back in the emergency room** 72-hours after discharge
- **Discharge summaries have real consequences and our current approach is broken.**



The Clarifying Care Solution

- Clarifying Care queries the data commonly captured in electronic health care records and **utilizes machine learning to generate a patient-friendly discharge summary.**
- Ultimately our solution will **save doctors time and reduce errors** while producing an output that's in a more **patient-friendly** and readable format.

Preventing avoidable
hospital readmissions
could save up to

\$15-20 Billion
and profoundly improve
patients' quality of life ²

♥ MVP Ingredients



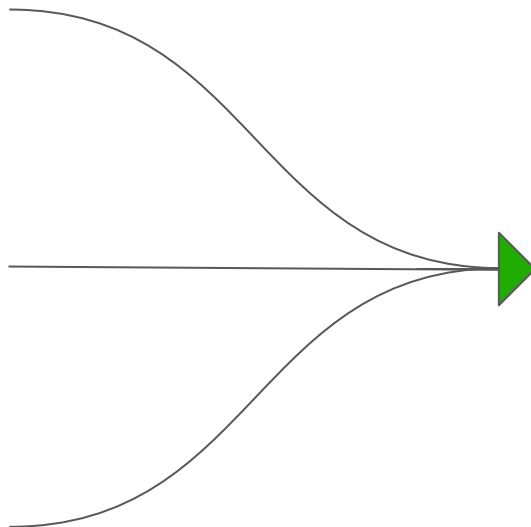
Hospital notes from [MIMIC-IV](#)



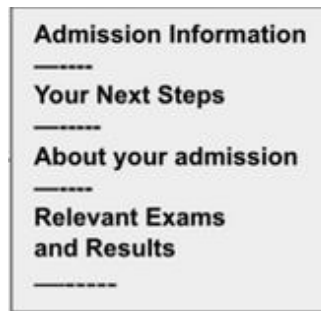
Board Certified Physicians and Nurses



Experienced Patient Feedback



MVP



Patient-Friendly Discharge Summary



Demo

CLARIFYING
CARE
EFFICIENT & EFFECTIVE DISCHARGE SUMMARIES

[Demo](#) [Analytics](#) [Our Mission](#)

Hospital Notes

note_id: 19248922-DS-8, hadm_id: 26833820

Name: ___ Unit No: ___

Admission Date: ___ Discharge Date: ___

Date of Birth: ___ Sex: M

Service: MEDICINE

Allergies:
Patient recorded as having No Known Allergies to Drugs

Attending: ___

___ Complaint:
Initiation of EPOCH

Major Surgical or Invasive Procedure:
Intrathecal methotrexate injection

History of Present Illness:
Patient is a ___ year old male with recently diagnosed non-Hodgkin's lymphoma, aggressive B cell with plasmacytoid differentiation s/p 1 round of dose adjusted R-EPOCH who presents for the initiation of EPOCH. He tolerated the treatment well, but his course was complicated by acute hypoxic

Patient Discharge Summary

Generating About your Admission Summary...

Admission Information

- Patient: John Doe
- Date of Birth: May 21, 1974
- Medical Record Number: 23020-01
- Admission Date: March 01, 2024
- Discharge Date: March 03, 2024
- Signing Physician: Carlo Archer
- Dictated By: Paulette Coffey
- Service Location: The service location where treatment was received is "Medical Oncology".
- Primary Care Provider: Dr. Erika Casey

Your Next Steps

Hospital Discharge Instructions

Based on the care you received at our medical facility, here are some discharge instructions specific to your situation:

1. Monitor your temperature and report any fever over 100.4°F to our office immediately.
2. Take your medication as directed by our staff and do not skip any doses.

Website Link: <https://www.clarifyingcare.com/app.html>

Example: Medication Instructions

Discharge Medications:

1. Acetaminophen 325 mg **P0 Q6H:PRN** pain



Here's a list of your prescribed medications at the time of discharge:

1. Acetaminophen 325 mg **orally every 6 hours as needed** for pain. Purpose: To provide pain relief as needed.

♥ Example: Diagnoses Made During Admission

Discharge Diagnosis:





1. Multiple falls
2. Rhabdomyolysis



Hospital Admission History

You were admitted to the hospital after experiencing a series of falls, which led to a diagnosis of rhabdomyolysis. This condition occurs when muscle tissue breaks down and releases waste products

Performance

-  **Simplifies:** defines medical acronyms like PO, BID, CXR into patient-friendly terms
-  **Explains:** translates medical terminology into easier to understand and patient-friendly language
-  **Extends:** adds normal ranges for measurements and provides medication purpose
-  **Organizes:** pulls information from various locations in input text into cohesive sections

Evaluation

Dale-Chall Readability Score: provides a grade-level readability estimate based on proportion of complex words vs. standard words

	Original Hospital Notes	Clarifying Care Output
Dale-Chall Score	9.29	8.21
Grade Level	College	11th - 12th grade

**Clarifying Care
consistently improved readability
to a high school level**



End User Survey

How well did the medical text explain medical terms and jargon?



How useful is the discharge summary for a patient?



How patient-friendly is the discharge summary in terms of organization and understandability?



♥ End User Feedback on Medication Instructions

How easily understandable was the medication instructions?



92% of users preferred the Clarifying Care output

Human in the Loop is Essential

- Purpose of medication may not account for off-label use
- Can include general instructions in with patient-specific instructions
- Hallucinations occur, balance between flexibility for explanations and restricting to source input

Technical Approach

Retrieval Augmented Generation

*“A technique for enhancing
the accuracy and reliability of generative AI models
with facts fetched from external sources.”*

1. **Generation**: Generation of response by a Large Language Model
2. **Augmentation**: An external data source with latest technical details
3. **Retrieval**: The mechanism to find relevant information

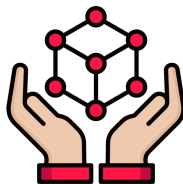
♥ Design Criteria



Data Sensitivity



Healthcare Data
Usage Guidelines



Information Relevance



Relevant answers
without fine tuning



Computational Efficiency



Less Time
and Resources



Design Flexibility



Replaceable Model
and Layout



Generation Pipeline

Original Discharge Summary



Split text and
Create Embeddings

0.6	-0.2	0.8	0.9	-0.1	-0.9	-0.7
0.7	0.3	0.8	-0.7	0.1	-0.5	-0.4
0.5	-0.6	-0.7	0.8	0.9	-0.7	-0.8
0.8	-0.1	0.8	-0.9	0.8	-0.5	-0.9

Embeddings

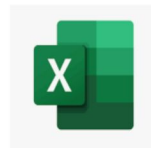
Store

FAISS
Scalable Search With Facebook AI



Vector Store

Prompt Templates



Read prompts
And Questions



Generate
Answers

Response

Response

Response

Response

Combine and
Format

Patient Friendly
Discharge Summary

Admission Information

Your Next Steps

About your admission

Relevant Exams
and Results



Future Directions

- Evaluate the reliability and accuracy of the generation pipeline by swapping Llama2 with different models
- Create an API layer to enable integration with an existing EHR system
- Extend the functionality to provide support for additional report formats
- Enhance the UI layer to allow editing to enable “Human in the loop” to improve upon the generated output

♥ Closing

We are living into our mission.

Clarifying Care aims to improve hospital efficiency and patient outcomes through the use of new innovative tools

♥ Learn more at clarifyingcare.com

