



# Towards an AI-based Application to Support Lab Results Comprehension

David Garner, Madelyn Dupuis, Shawntah Thomas, Zhe He, PhD, FAMIA  
Florida State University, College of Communication and Information



## Introduction

### Background:

- Healthcare is an ever evolving industry with constant moving parts.
- Online health information can be very difficult to navigate and can lead to loads of stress as well as health problems.
- Rapid increase in healthcare costs have shifted from medication and treatment norms to prevention and patient-centered care.
- Electronic health record systems and patient portals increase ease of access to medical records for patients.

### Problems:

- A large portion of the population suffering from chronic diseases are older adults who have limited experience with technology.
- Medical jargons can be difficult to understand and interpret especially when accessing health records online.
- Lab results can be confusing and interpreted differently across hospitals.

### Purpose:

- To create an AI-based application to allow users to easily view and comprehend lab test results based on their medical context.
- We will collect data on lab results and annotate the data to be used for the application.

## Methods

### Materials:

- Published Literature about Lab Result Comprehension
- Lab Result Interpretations from: [www.ahealthyme.com](http://www.ahealthyme.com)
  - 317 sections taken from this website to be annotated and coded
- INCEPTION Tool – used to code paragraphs
- Data that is being collected and annotated in INCEPTION:
  - Lab Test Names
  - Types of Lab Tests (i.e. Blood, Urine, etc.)
  - Alternative Lab Names for Panel Types
  - Result Interpretations
    - Normal results, abnormal results, indications, causes, actions, and conditions

### Procedure:

- Annotate lab result interpretation text which will be used to support the app development. Based on our coding and categorization, we can more efficiently group similar data for our app and this will compartmentalize our data when we later develop *Precious*. This annotation will allow us to provide customized interpretation for lab tests to patients based on their medical context.

## Implications

- The annotations of various health conditions will be used to assist with coding our intended app, *Precious*.
- This project will employ artificial intelligence to provide tailored information about lab results that consider the health literacy of the reader
- Provide user the direct comparison to other patients with a similar medical context using real world electronic health data
- Explore different visualization lab strategies
- Our project will provide a new eHealth technology to support self-management and investigate the design features that optimize the usability and accessibility of the technology

## Results

- We have coded 160 records of lab result comprehension text in the INCEPTION tool.
- The design of the app would be to enhance patient's understanding of their own results
  - Most individuals, young and old, may have very little knowledge about whether their lab test results are in a "good" or "bad" range (Zikmund-Fisher, 2019)
  - Patients gain more appreciation for their health
  - Examples:
    - Biomarker health (e.g. blood glucose levels for a patient with diabetes)
- Overall to improve eHealth technologies, we found that using intentional, relevant, and contextualized information to the reader is how we can improve communication for the portal patient (Zikmund-Fisher, 2019)

## Conclusion

- After conducting research and annotating numerous lab tests, we have created a foundation for our web based application, *Precious*, to be developed
  - By the end of the semester, we will have annotated 317 lab test comprehension records that will be incorporated in the coding process
  - From our research, we have established that there is a need for a user-based application among patients (Zikmund-Fisher, 2019)
    - Providing patients with their medical records via patient portals "reduces anxiety", "improved patient outcomes" and induces a more positive relationship between healthcare providers and patients (Tapuria et al., 2021)
- Goals**
  - Provide patients ease of access to their medical record
  - Effectively track and communicate patients' healthcare data to themselves and healthcare providers

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## Future Work

- We will create qualtrics surveys for middle-aged and elderly individuals to understand where and what older adults struggle with when faced with patient portals and interpreting lab result information.
- As we grow and gain more information, we would like to develop an app dedicated to eHealth and improving our overall quality of remote, at-home health
- Continue to apply for grants that can help fund our future research and work
- Continue to annotate and code for important factors and numerical ranges of different lab test results so that we can eventually implement them

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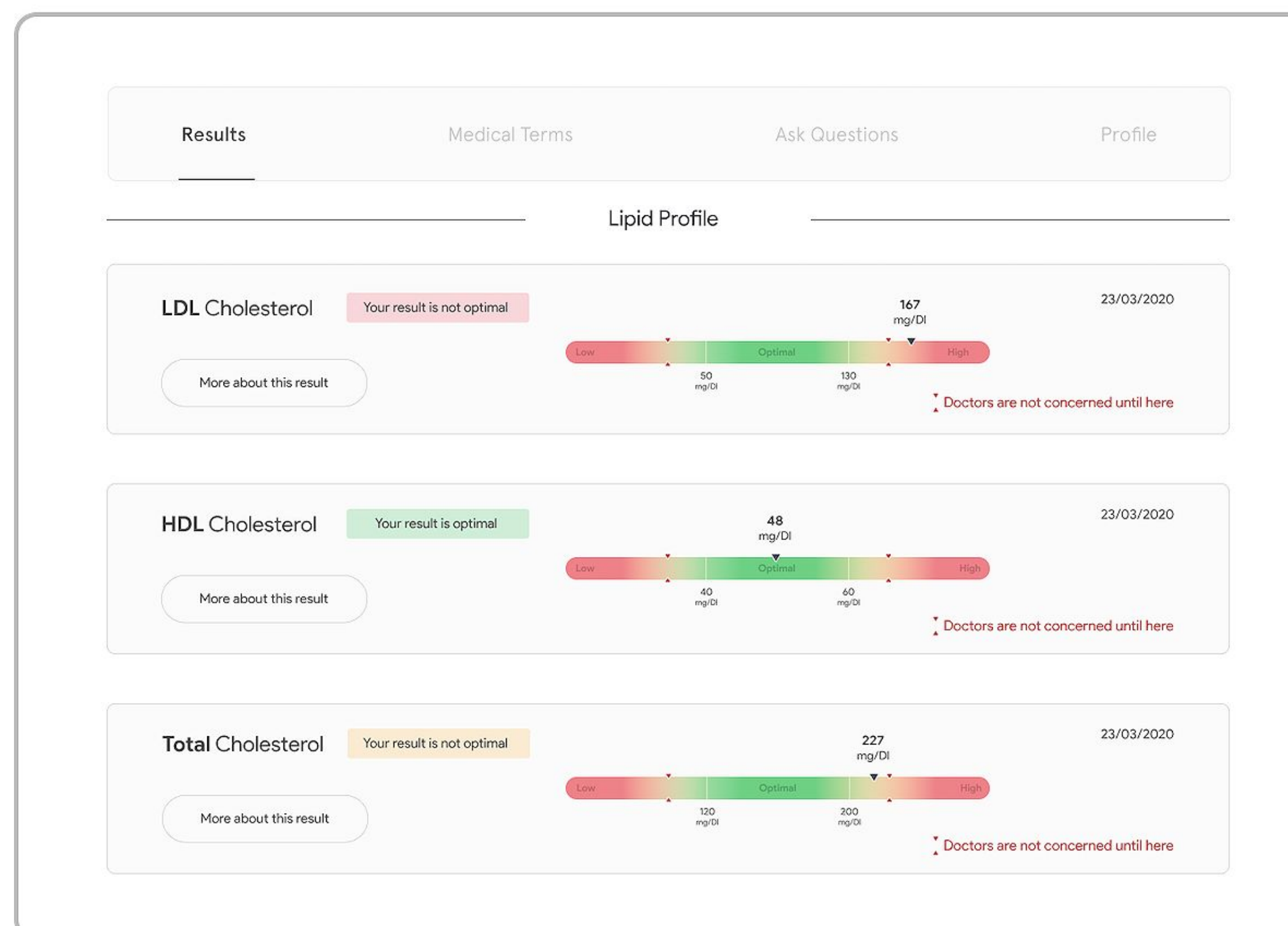


Figure 1: Ex. of lab test results for cholesterol that clearly show what a patient's results indicate. Displayed using an efficient visual aid that has color, explicitly explains when a doctor may be concerned (and implies that the patient should seek help), and shows the optimal range for a lab test score.

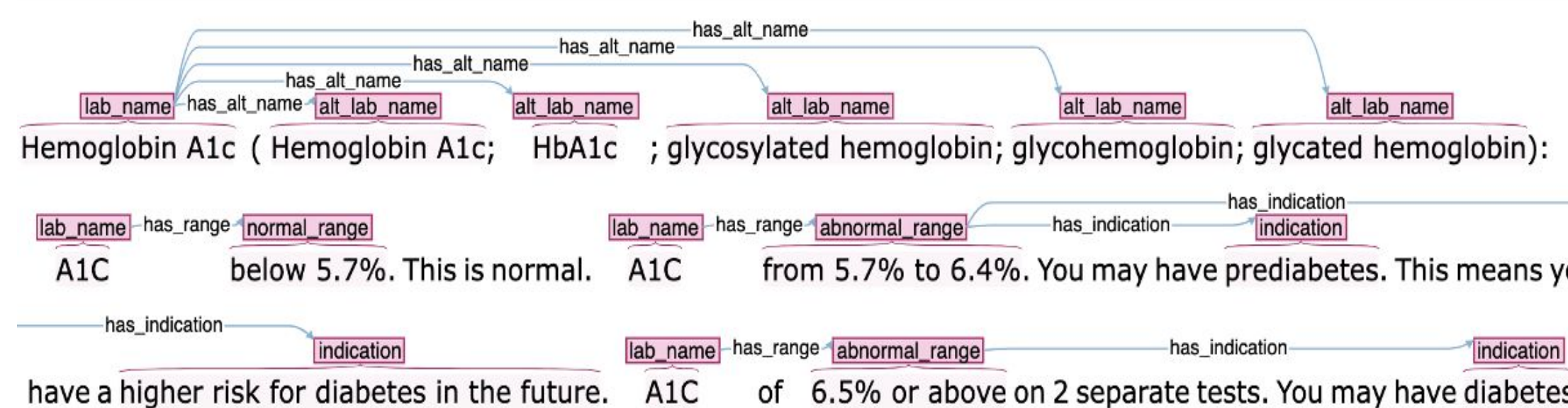


Figure 2: One example of an annotation done to show normal range and abnormal ranges and what they may indicate for Hemoglobin A1c

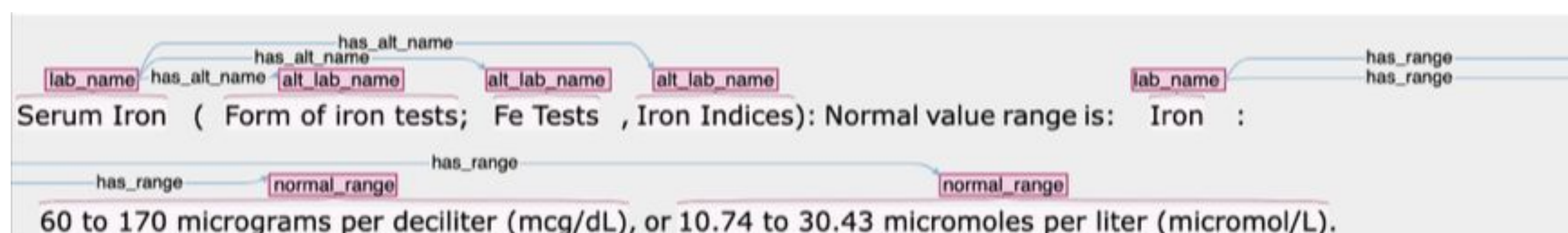


Figure 3: One example of an annotation done to show normal range for Serum Iron results