

Optimizing Digital Health Tools: LabGenie's Patient-Centered Visual Design

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Background & Significance

Clear and intelligible communication of laboratory results is essential for empowering older adults and improving their healthcare outcomes. However, despite advancements in digital health tools, many older patients still face significant challenges in understanding their lab results due to complex medical terminology and inconsistent presentations. These barriers can lead to confusion, reduced engagement in their care, and difficulties in making informed health decisions. Previous studies have shown that while patient portals increase access, they generally lack personalized explanations and interactive support, especially for older adults and those with limited health literacy.¹

Key Challenges & LabGenie's Approach

- **Obstacles in comprehension:** Complex medical terminologies, inconsistent presentations
- **Affects on patient care:** Confusion, reduced engagement, difficulty making informed decisions
- **LabGenie's solutions:** Visual designs developed from participant feedback, AI-driven portal for visual lab result interpretation, and enhanced patient-provider communication
- **Participatory design workshops:** Aim to gather data to refine user-friendly features

Methods

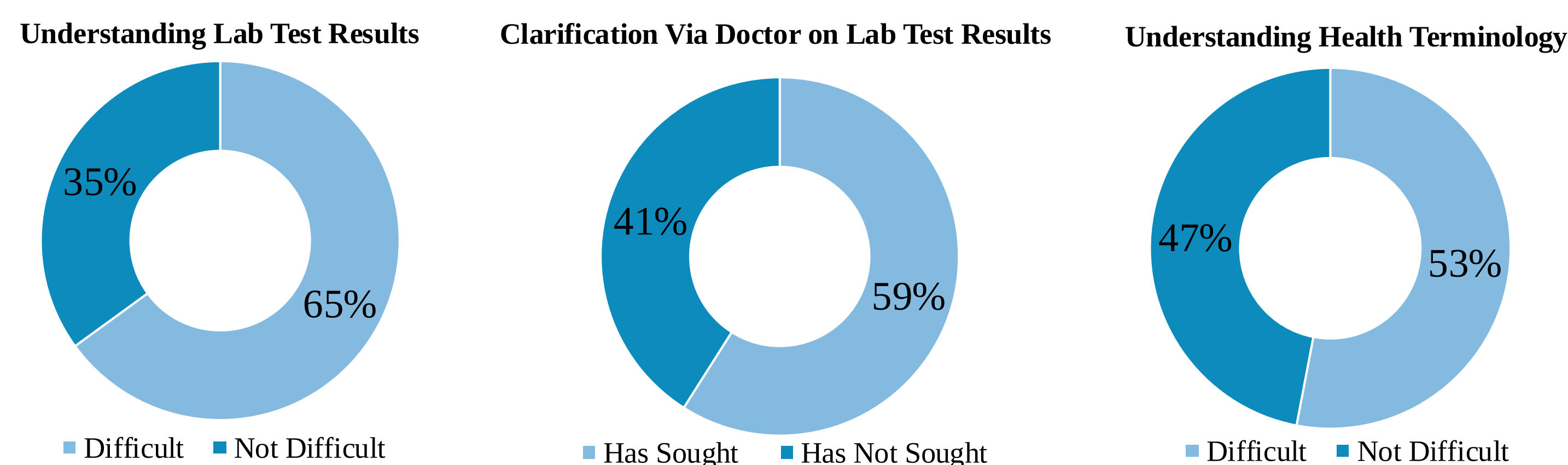
Study Design

Mixed-methods approach, incorporating preliminary patient surveys and analysis of systemic literature reviews followed by data collection via five workshops between Oct 2024 - Jan 2025.

Participant Cohort:

- Recruited from Telehealth Intervention for Seniors Program (NY), Tallahassee Senior Center (FL)
 - Three nursing homes (Eastchester, White Plains, Yonkers) in NYC (N=10)
 - Tallahassee Senior Center in FL (N=7)
- 17 participants (12 female and 5 male) over the age of 64 with one or more chronic conditions
 - 10 white or Caucasian, 5 black or African American, 2 not listed/left blank; 3 Hispanic
- Education: 3 high school or less, 7 some college or B.A. degree, 7 graduate/professional degree

Participant Survey Results:



Preliminary Designs:

- **Single test visualizations (4 types):** color vs. black & white, solid vs. gradient, text labels vs. no labels, "borderline" vs "risk" terminology
- **Trend visualizations (3 types):** color vs. black & white background, black dots on color vs. colored dots on white, goal range present vs. absent
- Visuals shown individually without side-by-side comparison
- Color scheme (red, green, yellow) designed for color-blind accessibility

References

1. Zhang, Z., Citardi, D., Xing, A., Luo, X., Lu, Y., & He, Z. (2020). Patient Challenges and Needs in Comprehending Laboratory Test Results: Mixed Methods Study. *Journal of Medical Internet Research*, 22(12), e18725. <https://doi.org/10.2196/18725>
2. Zikmund-Fisher, B. J., Scherer, A. M., Witteman, H. O., Solomon, J. B., Exe, N. L., Tarini, B. A., & Fagerlin, A. (2017). Graphics help patients distinguish between urgent and non-urgent deviations in laboratory test results. *Journal of the American Medical Informatics Association*, 24(3), 520–528. <https://doi.org/10.1093/jamia/ocw169>

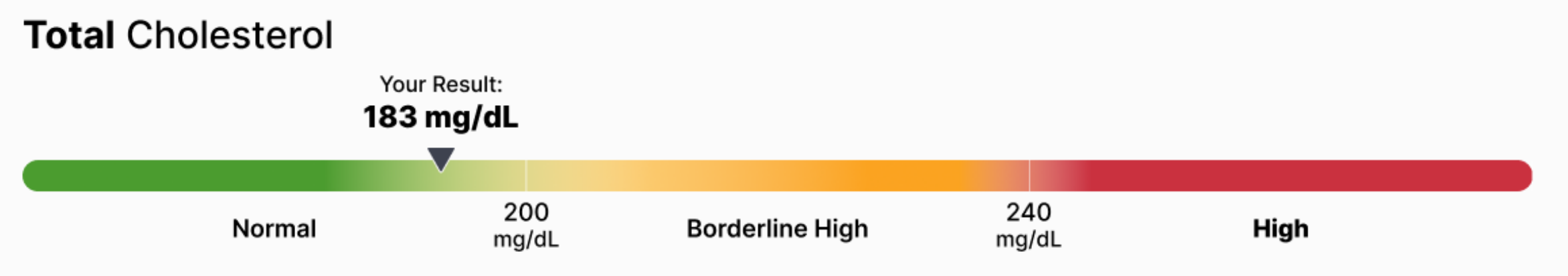


Figure 1 illustrates the visuals for gradient coloring versus solid coloring. This set of visuals was shown to the design workshop participants to evaluate and provide feedback.

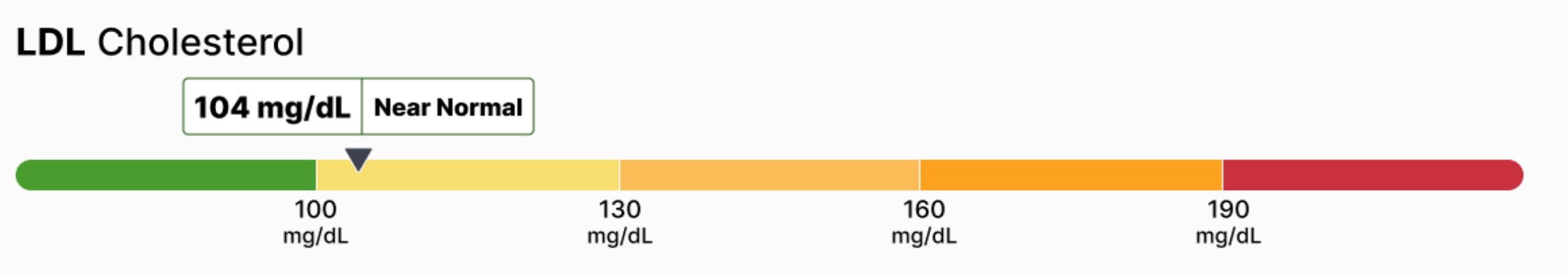
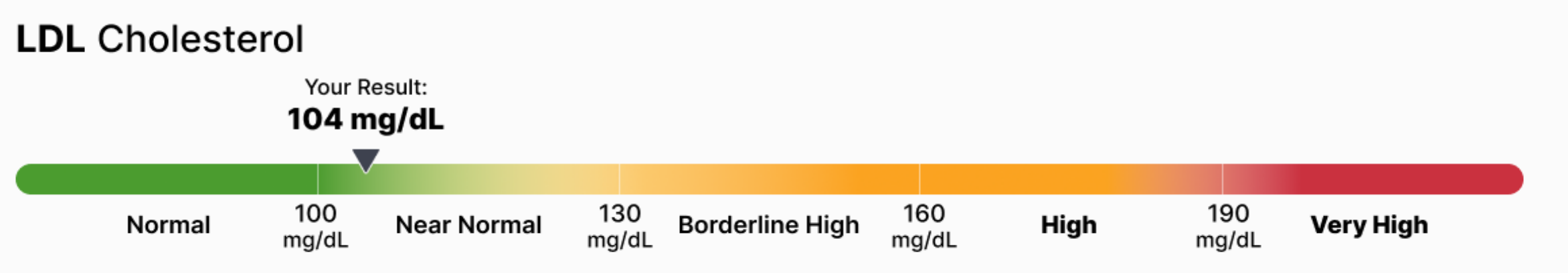
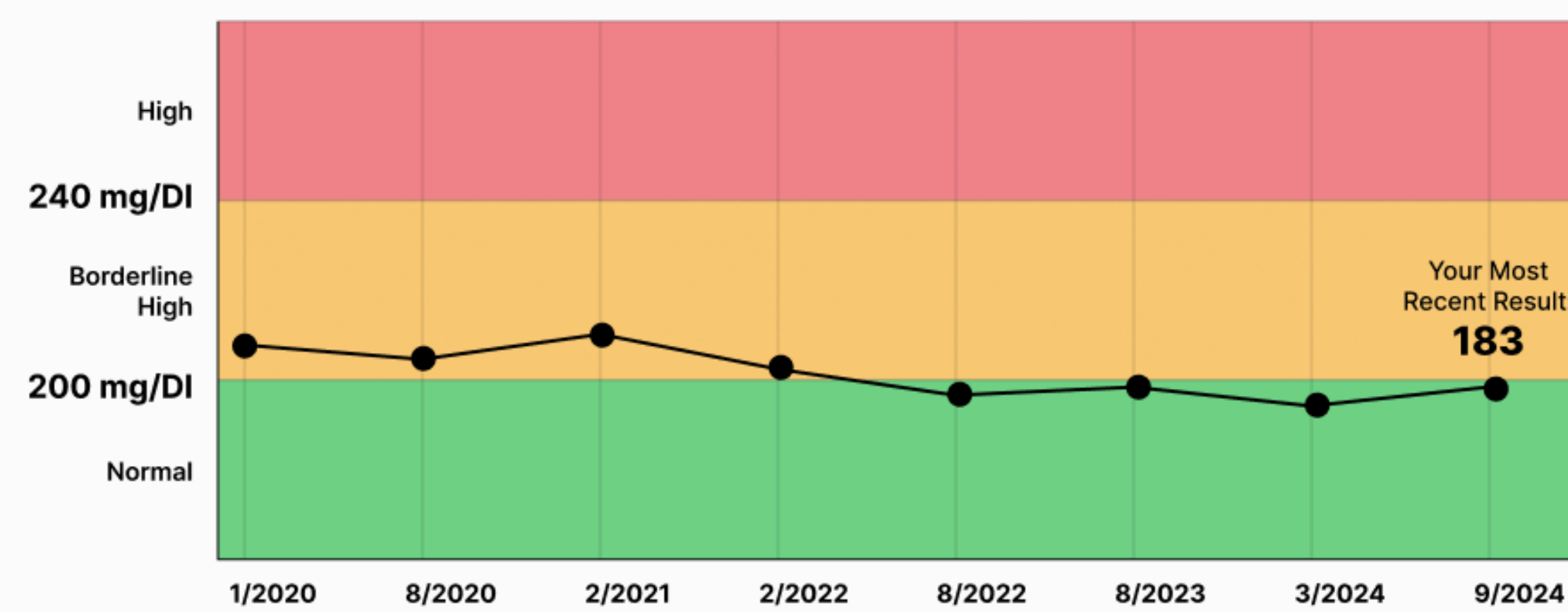


Figure 2 illustrates the visuals for present text labels versus no labels present. This set of visuals was shown to the design workshop participants to evaluate and provide feedback.

Total Cholesterol



Total Cholesterol

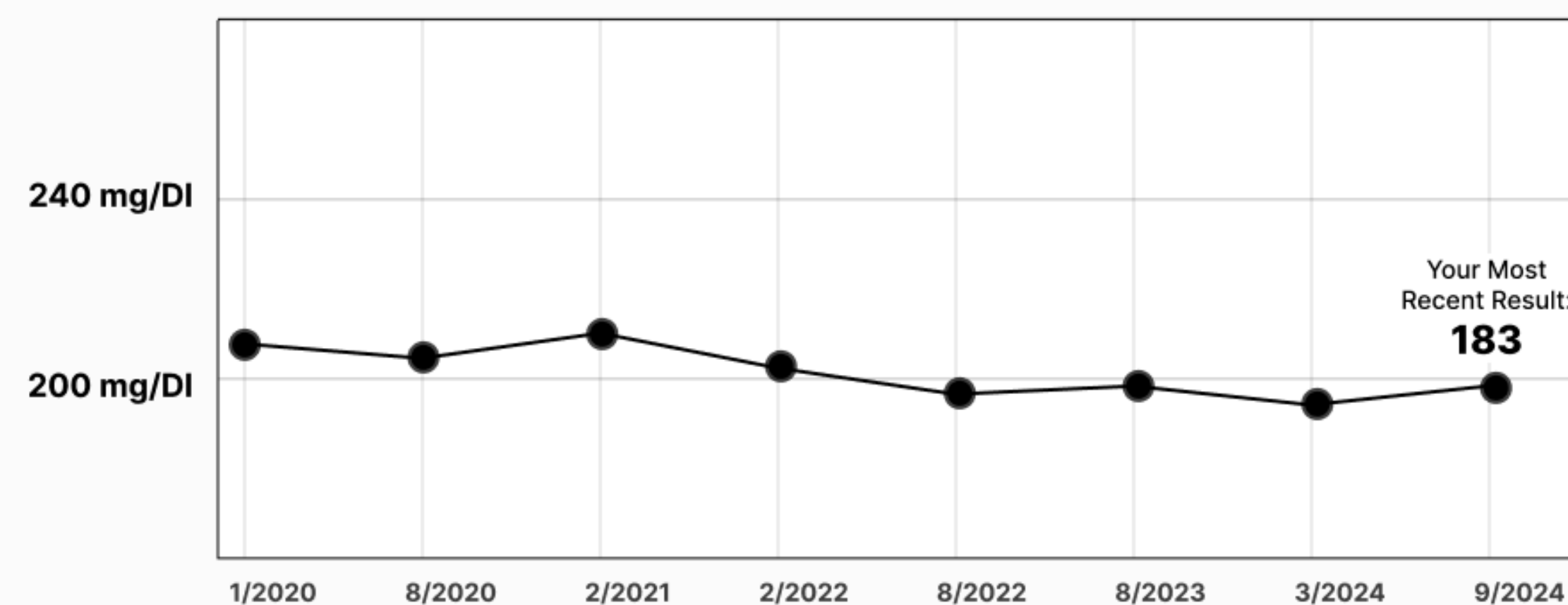


Figure 3 illustrates the visuals for trend analysis, color background versus black and white background. This set of visuals was shown to the design workshop participants to evaluate and provide feedback.

Results

Single Test Visualizations

Option	Count
Preferred First Option	14 (Color)
Preferred Second Option	2 (Black & White)
Preferred Third Option	1
Blank/Indifferent/Suggested	3 (Black)

Color vs. Black & White

Solid vs. Gradient Coloring

Text Labels vs. No Labels

"Risk" vs. "Borderline" Label

Trend Visualizations

Color Background vs. Black and White Background: 16 preferred color, 1 preferred B&W
- Trendline associated as a guide to track health over time; provides cues for ranges

Black Dots on Color vs Colored Dots on White: 11 colored background, 2 colored dots, 4 blank
- Colored background provides ranges while others said colored dots is more informative
- Participants (n=3) value "Your most recent results" label

Goal Range Present vs. No Goal Range Present: 12 preferred goal range, 5 blanks
- Provided goal range helps focus attention and understanding in trends and progress
- Note: participants confused about goal range's purpose and/or how it is produced

Conclusion & Future

Participants favored color visualizations for distinguishing health ranges and tracking trends, with solid colors preferred for clear warnings and gradients inspiring confidence. Text labels improved comprehension but could feel overwhelming; "Risk" labels conveyed urgency, while "Borderline" felt more motivating. Nearly all participants preferred a colored background for trend visualization. Future prototypes could incorporate customization to enhance user experience while ensuring clarity.

Refined prototypes will be tested in online experiment to assess their impact on older adults' lab result comprehension. Future research includes surveying patient access to lab results, evaluating generative AI for generating lab-related questions, and advancing the LabGenie prototype.

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