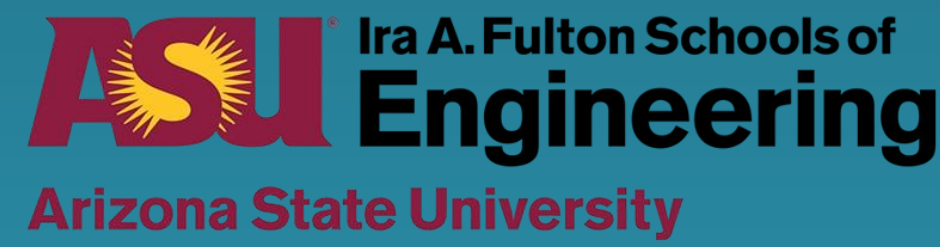
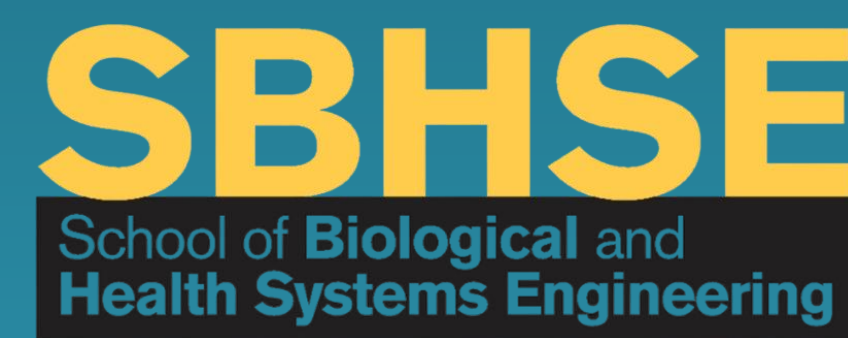


# Tele-Vision: A Portable Smartphone Adapter Device for Imaging the Eye's Anterior & Posterior Segments

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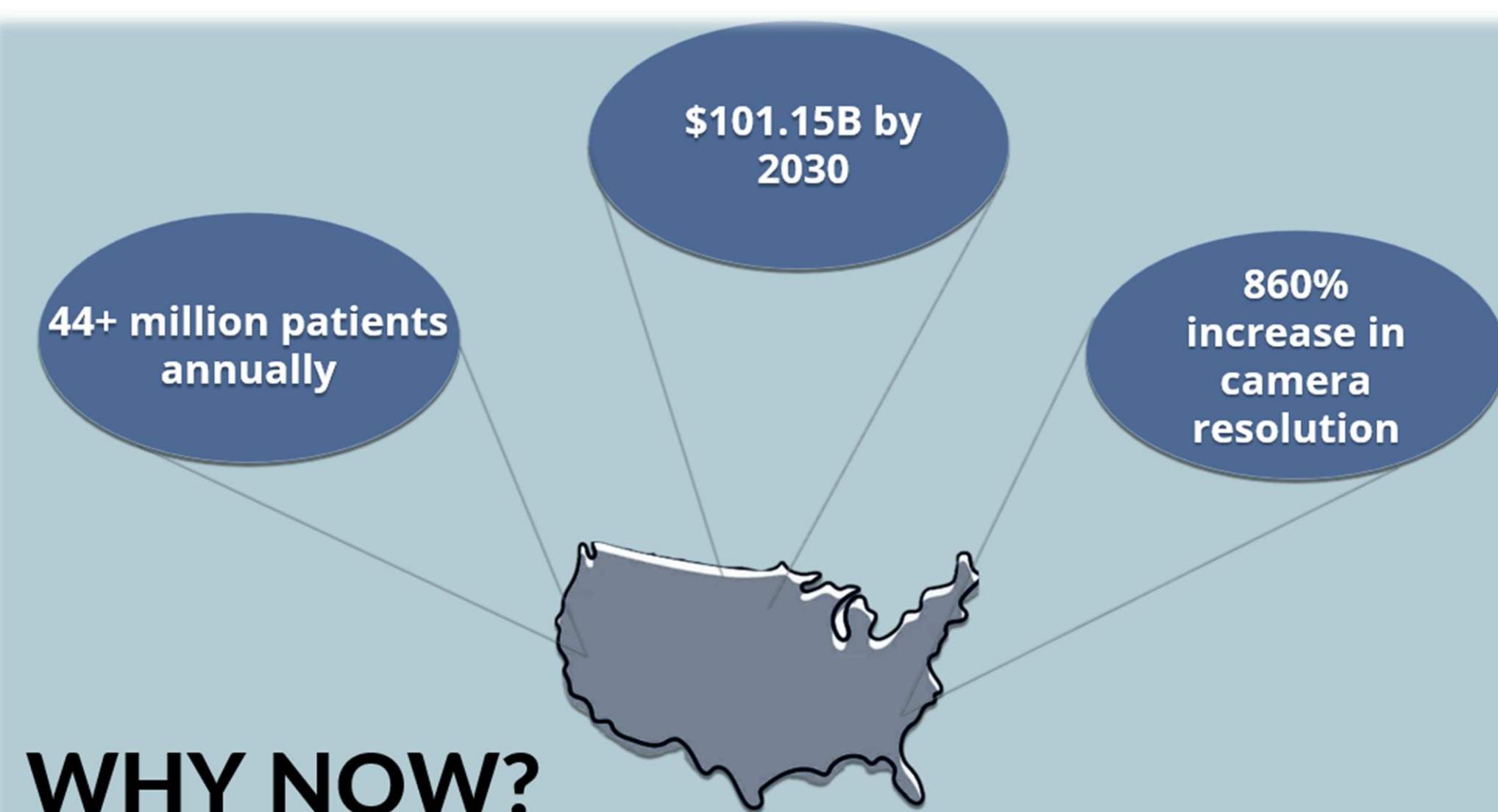
## Mission Statement

Our mission is to expand access to eye care with a smartphone-compatible imaging device, empowering non-ophthalmic specialists to capture clinical-grade images of the anterior and posterior eye segments.

We aim to reduce cost, expedite diagnosis, and enable earlier treatment for millions of patients worldwide.

## Background

- 1M ED visits for eye pain per year from 2018-2019
- 2.2 billion have preventable vision loss from limited access to specialists & equipment
- Need for a smartphone-compatible device that can be used even by non-specialists
- Supports Telemedicine and emergency care



## Acknowledgements

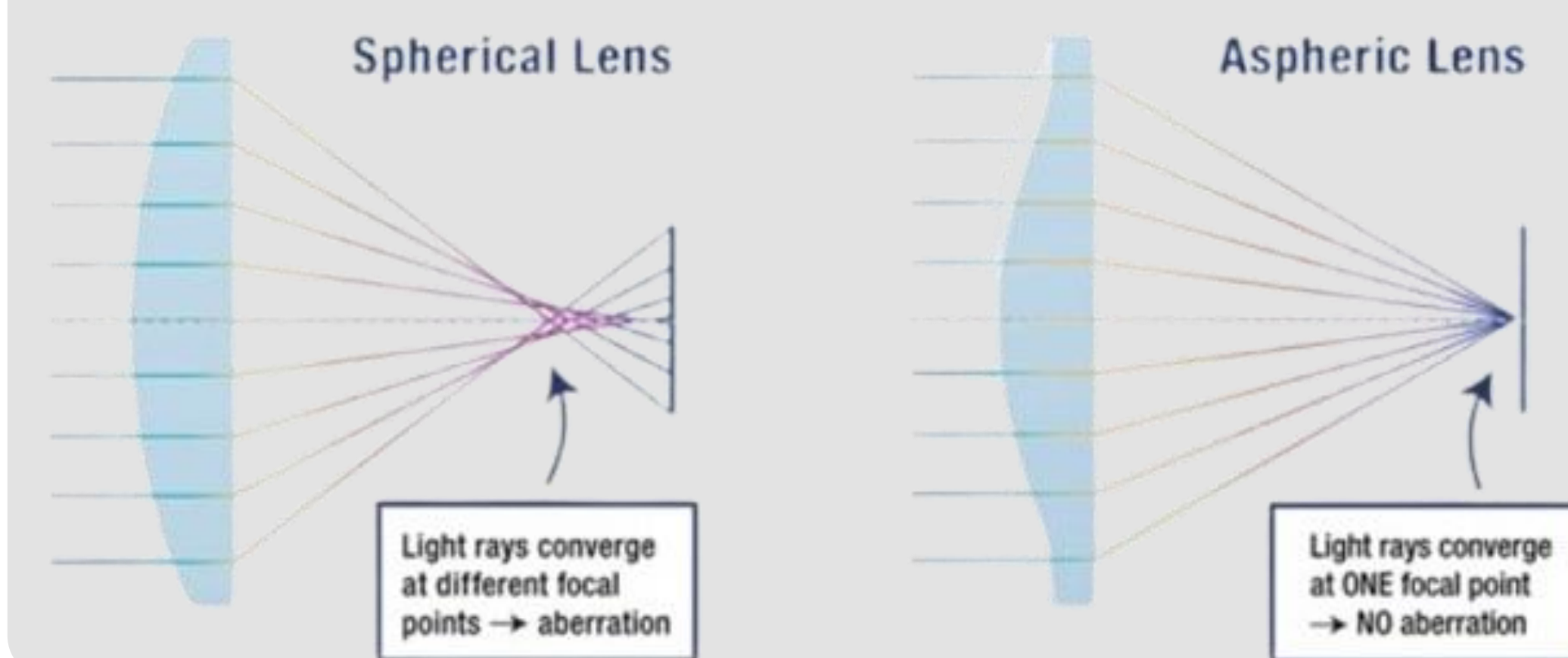
We sincerely thank our clinical mentors at the Mayo Clinic, the Synapse Program directors, and the SBHSE faculty for making this project possible.

## Technical Model

- Aspherical lens to enhance:
  - Field of view (FOV)
  - Resolution
  - Magnification

$$z(r) = \frac{r^2}{R \left( 1 + \sqrt{1 - (1+k) \frac{r^2}{R^2}} \right)} + \sum_{i=2}^n A_i r^{2i}$$

- Reduce aberrations
- Minimize distortion
- Yield sharper images at higher magnification



## Product Workflow

- High-quality images are uploaded to a HIPAA-compliant server → accessible for diagnosis *off-site*
- Potential additional components:
  - Macro and/or tetra-prism lenses
  - Mosaic stitching software
- Total approximated cost ~ \$400-\$800

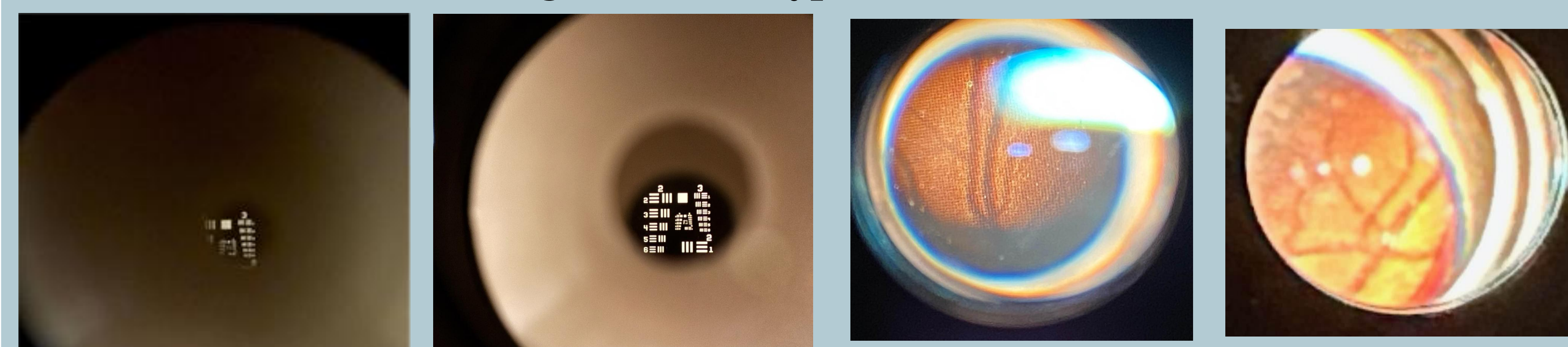
## Regulatory Requirements

- Class II (non-invasive, low risk to patient)
  - FDA 510(k) or premarket notification
- Light intensity & sterility safety evaluated via risk assessment tests
- ISO 13485 – manufacturing practices
- ISO 14971 – risk management

## Product Specifications

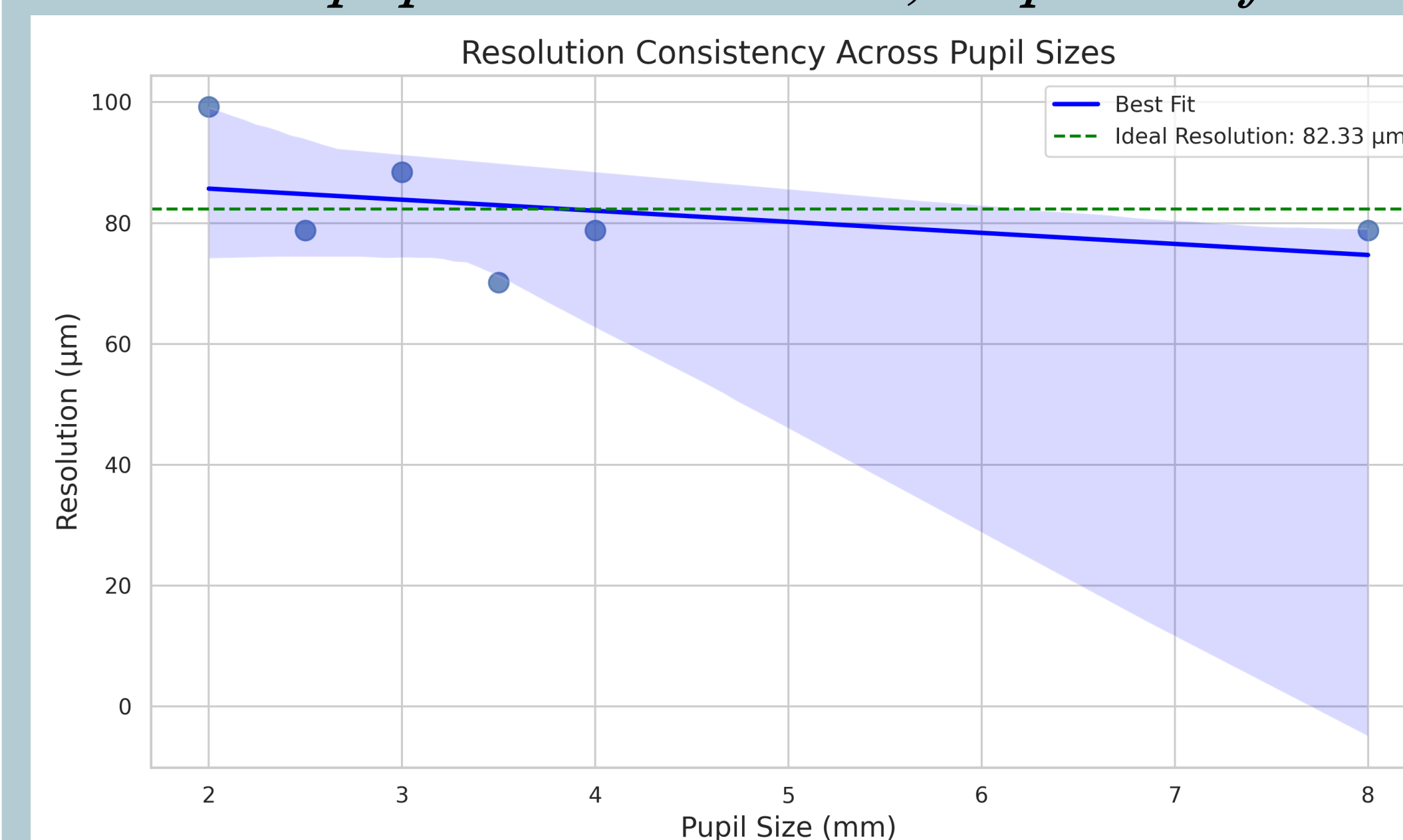
- Ease of Use: Intuitive for non-specialists
- Low Cost: Total cost under \$1000
- Quality:
  - Resolution ~82 μm
  - FOV > 20°
  - Magnification > 8x
- Patient Comfort: Minimal light intensity, no need for pupil dilation
  - < 1 min capture time
- Compatibility: 3D print phone case across smartphone models
- Durability: Long-lasting, reusable, easy to sterilize

## Posterior Segment Prototype and Verification Results:



Resolution target image captured with 2 mm and 8 mm pupil dilation models, respectively

Images of model eye retina captured with posterior segment prototype



- Standard Deviation: 9.21 μm
- R<sup>2</sup> (Fit Quality): 0.1535
  - Only 15.35% of variation explained by pupil size, i.e., resolution is not strongly dependent on pupil size

$$\text{Resolution} \left[ \frac{\text{lp}}{\text{mm}} \right] = 2^{\text{Group} \# + \frac{\text{Element} \# - 1}{6}}$$

Thorlabs 1951 USAF Resolution Target used for posterior segment validation testing

## The Bigger Picture: Posterior + Anterior

### Anterior Segment:

Current iteration of this device is compatible with iPod OS and captures anterior segment:



*In progress:*  
Clinical trials  
in Emergency  
Department

\$15,000 tabletop device      **Tele-Vision**

## Milestones Timeline

- May 2025:** IRB submission for validation of anterior segment in Mayo ED
- Dec 2025:** ED clinical trial to validate posterior segment
- Feb 2026:** Ensure software compatibility with iPhone 16e
- Jan 2027:** Expand compatibility to Android & integrate into clinical practice