



## BACKGROUND

- Hypertension (HTN)** is an important public health condition, and digital health interventions have been researched and used to control HTN<sup>4-6</sup>.
- The MI-BP app** is a smartphone-based mobile health (mHealth) intervention developed by Michigan Medicine that helps African Americans with uncontrolled HTN manage HTN to reduce health disparities in HTN<sup>10</sup>.
- Costs of developing, studying, and delivering mHealth HTN-management approach are not well understood in marginalized populations.

## METHODS

### Data source and study population

- A 1-year randomized controlled trial (RCT) comparing enhanced usual care (EUC) and EUC + MI-BP was assessed for research and clinical delivery costs from a healthcare perspective.
- 167 uncontrolled African American adults with uncontrolled hypertension aged 25-70 years from Detroit, Michigan were studied from the baseline.

### Data analysis

- Using a micro-costing approach, the research setting analyzed the 5-year costs including preparation and research stages of the trial, while the clinical setting examined the 1-year patient-related cost within the trial, both considering labor, equipment, and follow-up costs.
- We calculated the total costs in both settings, and the monthly per-patient costs in the clinical setting specifically.
- Sensitivity analyses were performed to identify key cost determinants and assess the interaction effect of the patient number and retention.

## LESSONS LEARNED

- The RCT for studying effectiveness of MI-BP cost **\$1,537,192** in total. The average monthly cost per patient in a clinical setting was **\$139**.
- The primary cost determinant in both settings was the labor cost, accounting for **76.24%** and **72.68%** of the total cost, respectively.
- In the research setting, modifying the patient volume from 100 to 1,000 would increase the total cost by **\$643,904 (\$1,489,043 to \$2,132,946)**
- In the clinical setting, changing patient volume from 100 to 1,000 would reduce monthly per-patient costs by **\$185 (\$221 to \$36)**.
- Monthly per-patients costs are expected to be **\$170/month** in the year of system configuration and **\$127/month** in other years. If configuration occurs once every 2 years, the average monthly per patient cost is **\$150**, but reconfiguration every 8 years decreases that to **\$134**.

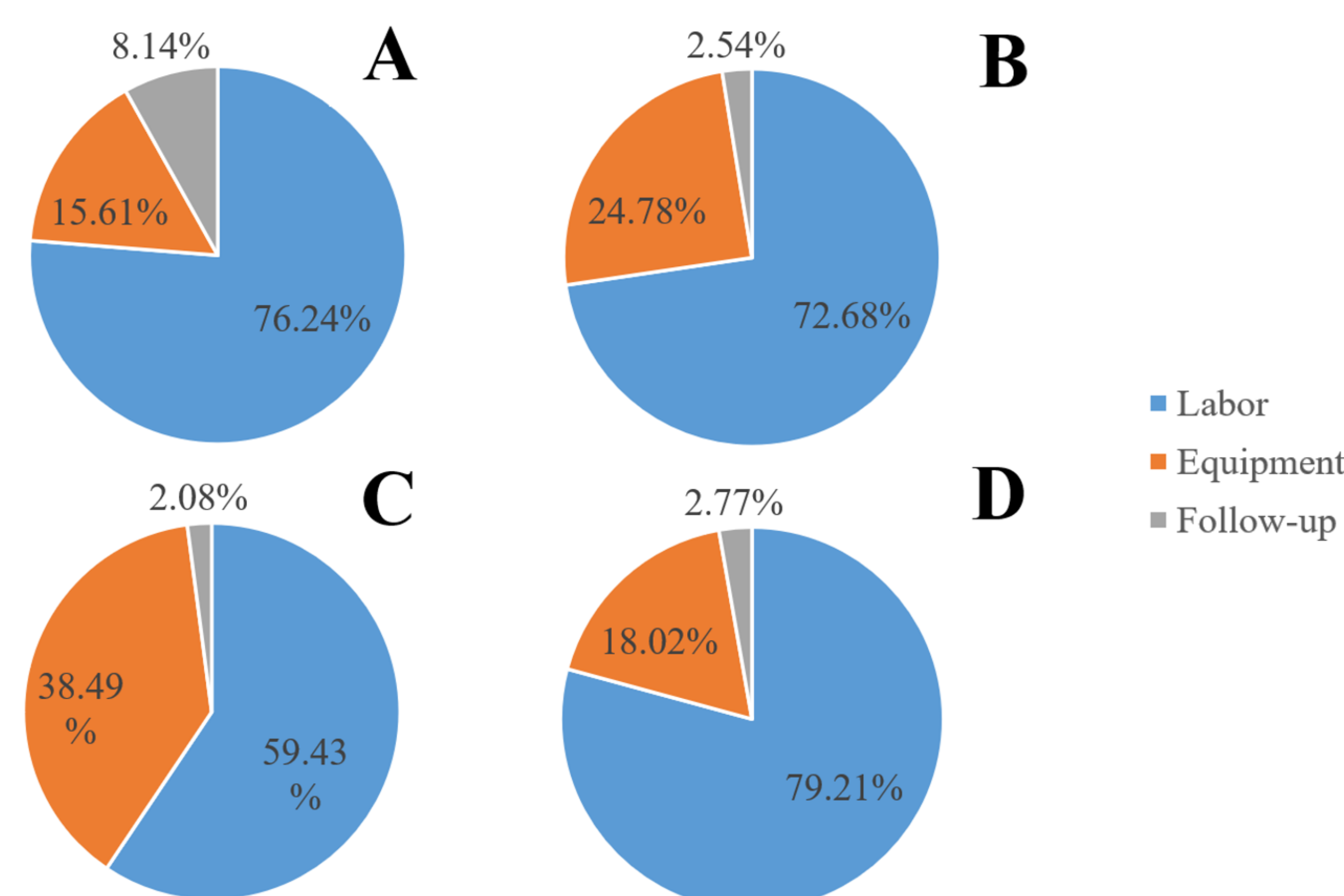
## LIMITATIONS

- Underestimation:** This study was conducted during the COVID-19 pandemic. The difficulties for patient recruitment led to a potential underestimation of the follow-up cost.
- Patient attrition:** Adjusting for the stochastic impact of the patient retention on the costs is also necessary.
- Study perspective:** Additional studies from patient perspective and other locations may facilitate better decision-making and alleviate disparities related to hypertension care plans.

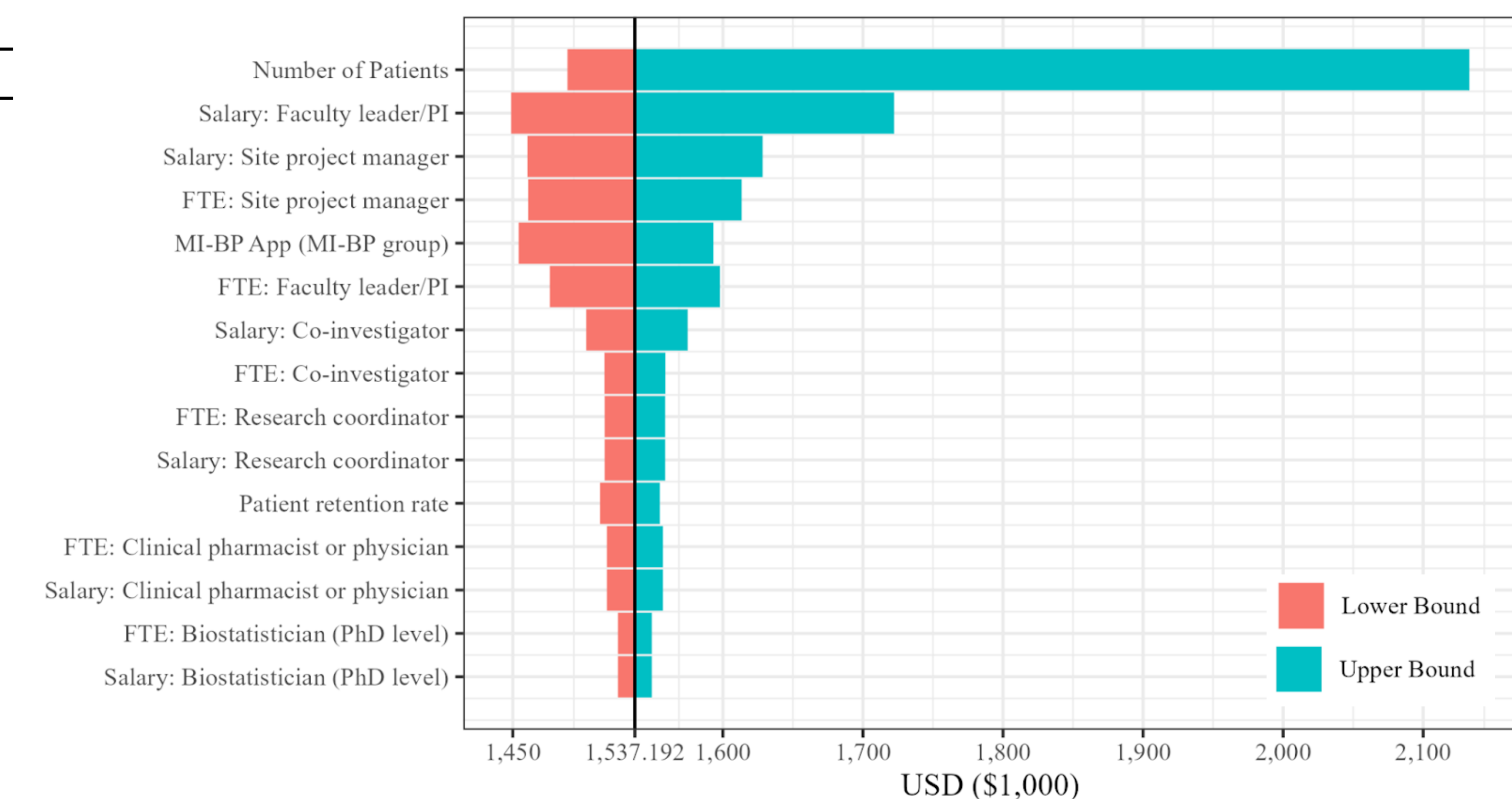
## RESULTS

**Table 1. Example input for the research (5-year) and the clinical delivery setting (1-year).**

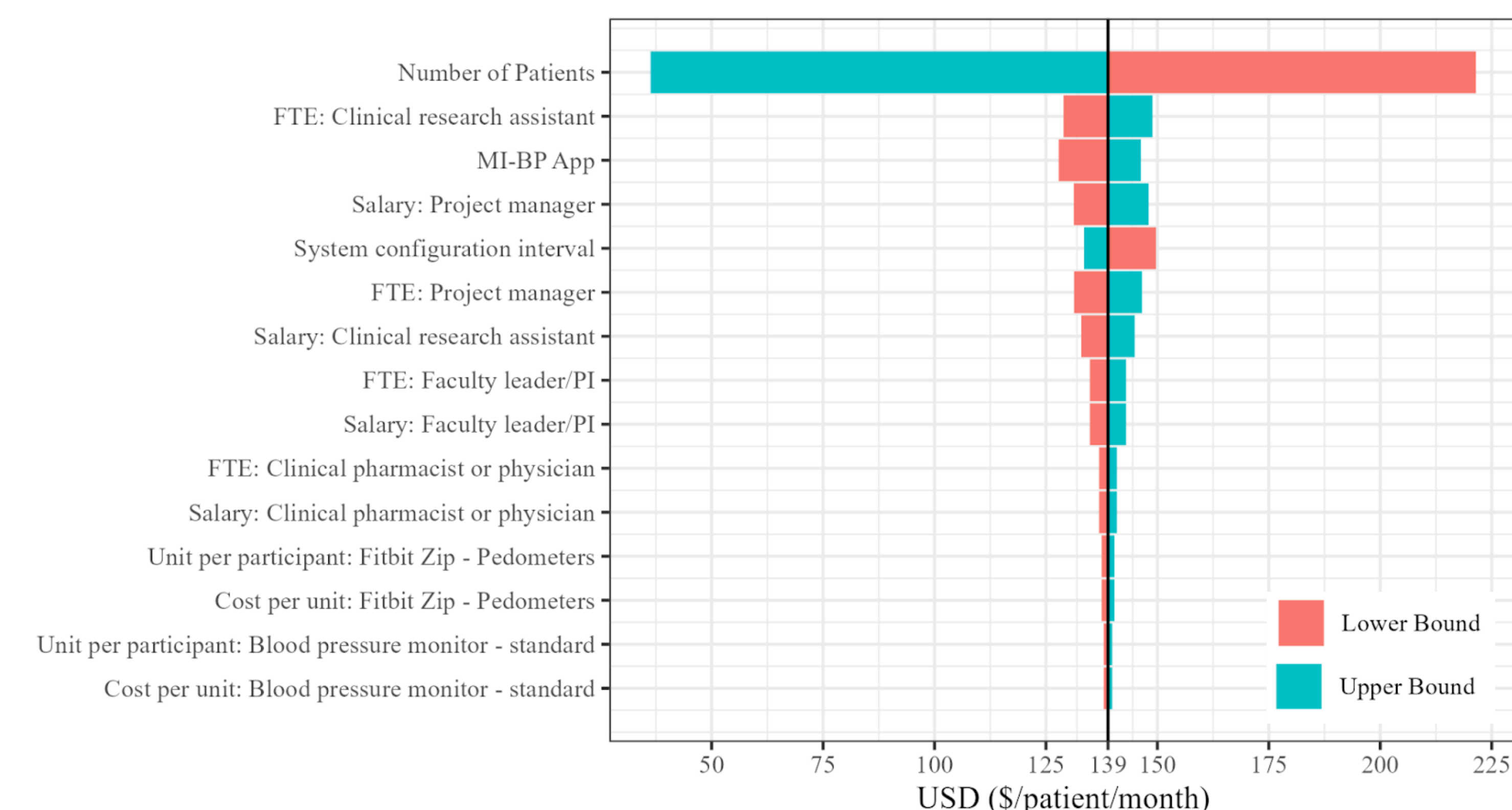
Parameters	Research (range), \$	Clinical delivery (range), \$
<b>Annual salary (per person)</b>		
Faculty leader/PI	151,895 (107,701 - 244,440) <sup>a</sup>	203,700 (162,960 - 244,440)
Co-investigator	181,544 (123,618 - 244,440) <sup>a</sup>	-
Site project manager	72,619 (58,000 - 90,000) <sup>a</sup>	72,619 (58,000 - 90,000)
Clinical research assistant	40,000 (32,000 - 48,000)	40,000 (32,000 - 48,000)
Research coordinator	83,218 (66,574 - 99,861)	-
Data manager	66,000 (52,800 - 79,200)	106,888 (85,510 - 128,266)
Clinical pharmacist/physician	100,000 (80,000 - 120,000)	100,000 (80,000 - 120,000)
Biostatistician (PhD level)	202,000 (161,600 - 242,400)	-
Data analyst (Master level)	106,888 (85,510 - 128,265)	-
<b>FTEs (over entire period)</b>		
Faculty leader/PI	2.0 (1.6 - 2.4)	0.2 (0.2 - 0.2)
Co-investigator	0.6 (0.5 - 0.7)	-
Site project manager	5.3 (4.2 - 6.3)	1.1 (0.8 - 1.3)
Clinical research assistant	1.3 (1.0 - 1.5)	1.5 (1.0 - 1.5)
Research coordinator	1.3 (1.0 - 1.6)	-
Data manager	0.3 (0.2 - 0.3)	0.1 (0.0 - 0.1)
Clinical pharmacist/physician	1.0 (0.8 - 1.2)	0.2 (0.2 - 0.2)
Biostatistician (PhD level)	0.3 (0.2 - 0.4)	-
Data analyst (Master level)	0.4 (0.3 - 0.5)	-
<b>Fixed equipment costs</b>		
MI-BP App Development	153,000 (70,000 - 209,000)	-
Configuration year	-	102,000 (28,000 - 146,000)
Non-configuration year	-	17,000 (14,000 - 21,000)
Amortized average	-	39,962 (17,804 - 54,724)
System configuration interval	-	4 (2 - 8)
<b>Variable equipment costs</b>		
Blood pressure monitor, pedometers ...	.....	.....
<b>Follow-up costs</b>		
Recruitment, urine tests, blood tests...	.....	.....
<b>Participants</b>		
Number of patients	167 (100 - 1,000)	167 (100 - 1,000)
Patient retention (Patient engagement)	52% (25% - 75%)	52% (25% - 75%)



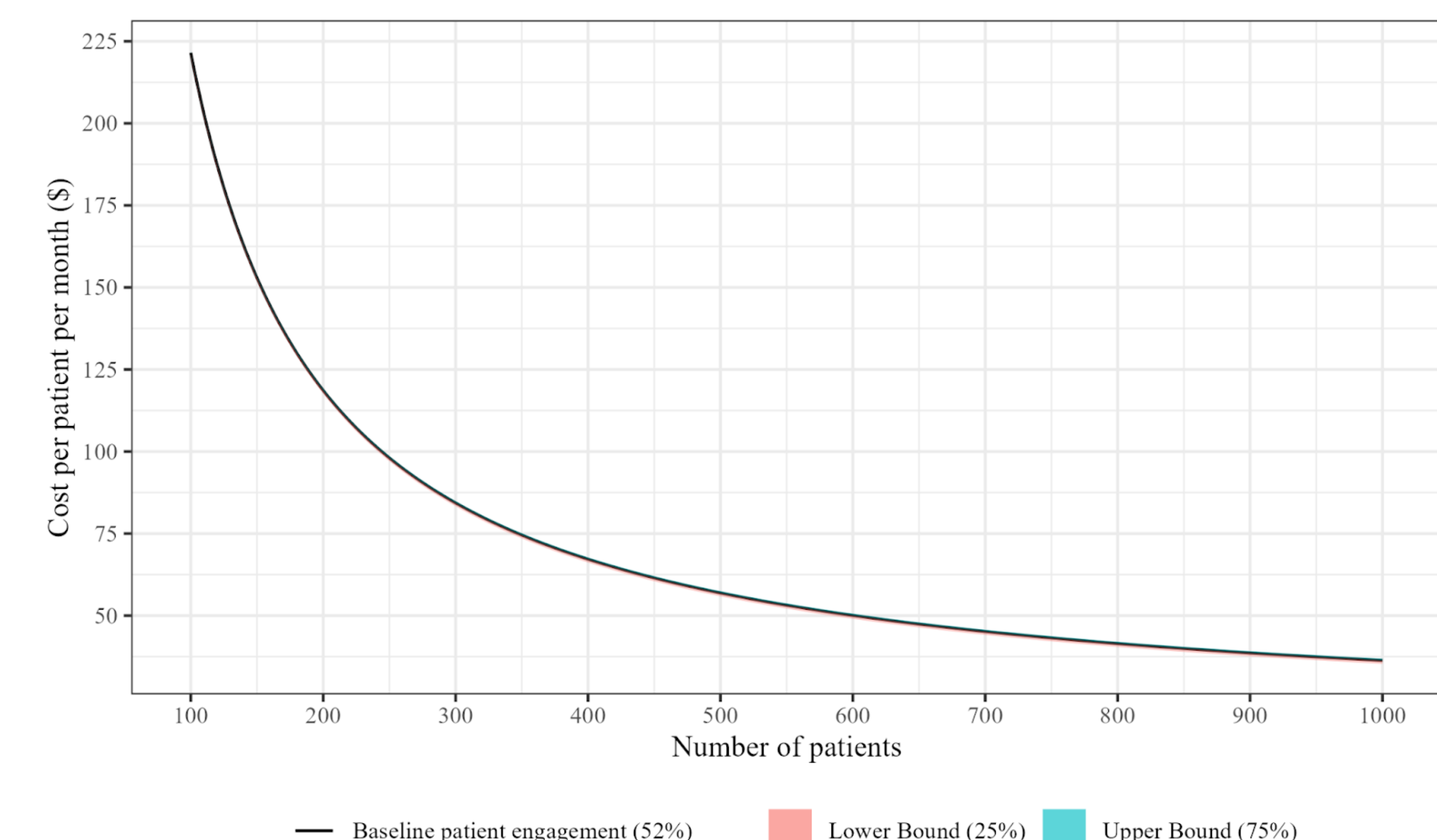
**Figure 1. Proportion of costs in research setting (A), amortized average clinical setting (B), configuration-year clinical setting (C), and non-configuration-year clinical setting (D).**



**Figure 2. Tornado diagram of the total cost in the research setting.**



**Figure 3. Tornado diagram of the monthly cost per patient in the amortized average clinical setting.**



**Figure 4. Impact of patient number and engagement on the monthly cost per patient in amortized average clinical setting.**