

# **OPENFDA MEDICAL DEVICE ADVERSE EVENT ANALYSIS**

Analysis of FDA Medical Device Adverse Event Reports

# Table of Contents

<b>1. Executive Summary</b>	<b>2</b>
<b>2. Methodology</b>	<b>2</b>
2.1. Data Source . . . . .	2
2.2. Data Standardization and Fuzzy Matching . . . . .	2
2.3. Problem Classification and Data Quality Filters . . . . .	2
2.4. Concentration-Based Analysis Methodology . . . . .	3
2.5. Statistical Analysis of Temporal Trends . . . . .	3
<b>3. Temporal Trend Analysis</b>	<b>4</b>
3.1. Overall Reporting Trends . . . . .	4
3.2. Statistical Trend Analysis . . . . .	5
3.3. Cumulative Reports Over Time . . . . .	6
<b>4. Product Problem Analysis</b>	<b>7</b>
4.1. Product Problems Analysis . . . . .	7
<b>5. Patient Problem Analysis</b>	<b>9</b>
5.1. Patient Problems Analysis . . . . .	9
<b>6. Manufacturer Analysis</b>	<b>10</b>
6.1. Top Manufacturers . . . . .	10
<b>7. Device Brand Analysis</b>	<b>11</b>
7.1. Top Device Brands . . . . .	11
7.2. Brand Temporal Trends . . . . .	12
<b>8. Technical Appendix</b>	<b>12</b>
8.1. Data Source . . . . .	12
8.2. Analysis Tools . . . . .	13
8.3. Exclusion Criteria . . . . .	13
8.4. Report Metadata . . . . .	13

# 1. Executive Summary

This report analyzes **268** FDA medical device adverse event reports submitted between **August 25, 2024** and **October 29, 2025** (a period of **14.1** months). The dataset includes **1** unique manufacturers and **10** unique device brands. The average reporting rate was **22.3** reports per month, with peak reporting of **68** reports in **September 2025**.

Table 1: Summary statistics of FDA MAUDE reports

Metric	Value
Total Reports	268
Date Range	August 25, 2024 to October 29, 2025
Reporting Duration	430 days (14.1 months)
Unique Manufacturers	1
Unique Device Brands	10
Average Monthly Reports	22.3 reports/month
Maximum Monthly Reports	68 reports in September 2025

# 2. Methodology

## 2.1. Data Source

The search of the FDA Manufacturer and User Facility Device Experience (MAUDE) database was conducted using the openFDA Device Event API. Retrieved JSON-formatted data were downloaded directly from the API and subsequently processed and cleaned for analysis.

## 2.2. Data Standardization and Fuzzy Matching

The analysis employs fuzzy matching algorithms to standardize manufacturer and brand names, addressing inconsistencies in naming conventions across reports. FDA MAUDE reports often contain variations in manufacturer and brand name spelling, capitalization, and formatting (e.g., different spellings, capitalizations, and legal entity suffixes such as “INC”, “Inc.”, or “LLC”).

**Fuzzy String Matching Approach:** Textually similar names are identified and grouped using the Levenshtein distance algorithm, which calculates the minimum number of single-character edits needed to transform one string into another. This standardization process uses the **RapidFuzz** library with partial ratio matching.

**Matching Thresholds:** Manufacturer names with  $\geq 65\%$  similarity and brand names with  $\geq 75\%$  similarity are consolidated under a canonical representation (typically the shortest variant). This reduces artificial fragmentation in the data and provides more accurate reporting volume estimates per manufacturer and brand.

## 2.3. Problem Classification and Data Quality Filters

Patient and product problems are extracted and categorized, excluding non-informative categories to focus on meaningful data patterns.

### **Key Considerations:**

- Individual reports may list multiple product problems per incident
- Individual reports may list multiple patient problems per incident
- Total problem occurrences can exceed the total number of reports
- Each problem occurrence is counted separately to identify the most frequent failure modes and issues

Non-informative categories are excluded from both patient and product problem analyses. For the complete list of excluded categories, see [Section 8.3](#) in the Technical Appendix.

## **2.4. Concentration-Based Analysis Methodology**

This analysis employs a concentration-based approach to identify the critical few problems, manufacturers, and brands that account for the majority of occurrences. Rather than arbitrarily selecting a fixed number (e.g., “top 10”), we dynamically identify categories that collectively represent approximately 80% of all reported occurrences.

**Implementation:** For each category (problems, manufacturers, brands), items are ranked by frequency and cumulative percentages calculated. Items are included in the main analysis if the previous item’s cumulative percentage was below 80%. This ensures complete categories are included—no category is split between the main analysis and “Other”.

**Key Features:** The exact percentage may exceed 80% to maintain category integrity. All categories meeting the threshold are listed, not just a predetermined number. The “Other” category provides perspective on the long-tail distribution of remaining items.

## **2.5. Statistical Analysis of Temporal Trends**

**Variability Metrics:** Standard Deviation (SD) measures the typical spread of monthly reports around the average. Coefficient of Variation (CV) expresses SD as a percentage of the mean ( $CV = SD/\text{Mean} \times 100$ ), enabling relative comparison.  $CV < 15\%$  indicates low variability, 15-30% moderate, and  $>30\%$  high variability in reporting patterns.

**Outlier Detection:** Z-scores measure how many standard deviations each month’s report count deviates from the mean. Months with z-scores  $\geq |2|$  are flagged as statistically significant outliers ( $p < 0.05$ ), indicating unusually high (peaks) or low (valleys) reporting activity beyond approximately 95% of normal distribution.

### 3. Temporal Trend Analysis

#### 3.1. Overall Reporting Trends

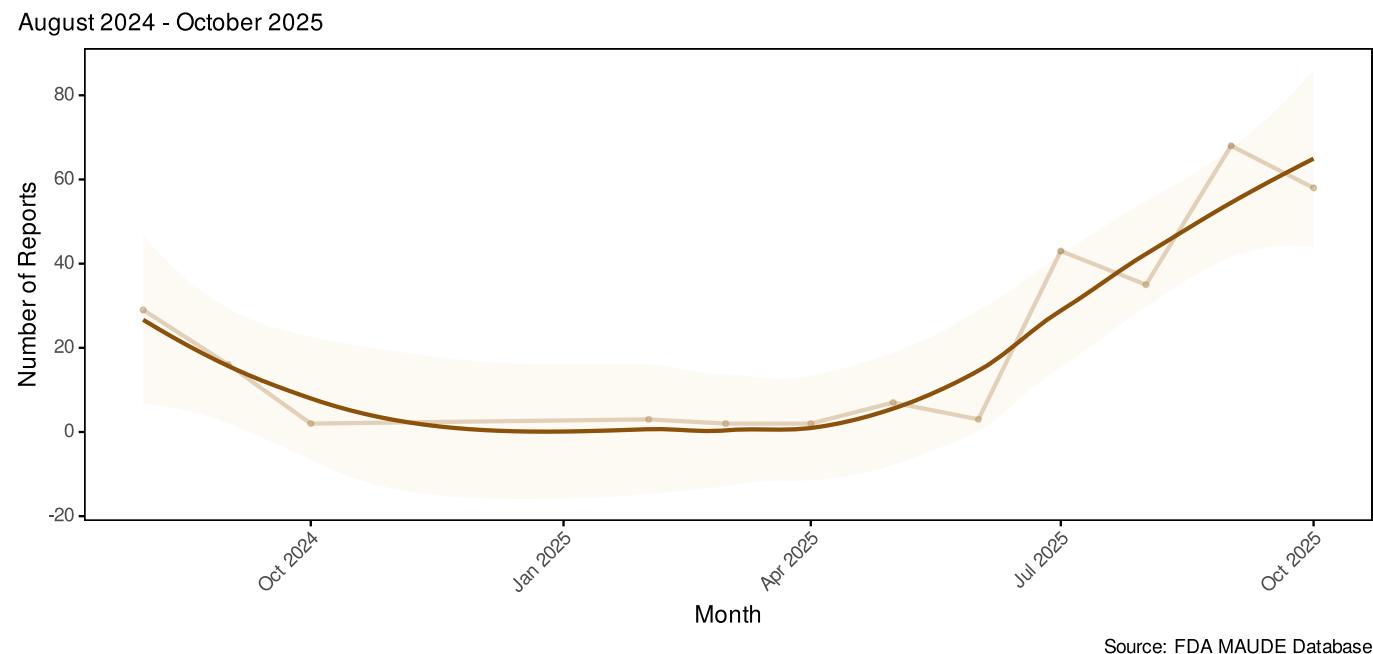


Figure 1: Monthly trend of FDA MAUDE reports

### 3.2. Statistical Trend Analysis

**Reporting Variability:** The average monthly reporting rate is **22.3** reports (SD = **23.8**, CV = **106.8%**).

**Statistically Significant Peaks** ( $\geq 2$  SD above mean,  $p < 0.05$ ):

No statistically significant peaks detected at 95% confidence level.

**Statistically Significant Valleys** ( $\geq 2$  SD below mean,  $p < 0.05$ ):

No statistically significant valleys detected at 95% confidence level.

### 3.3. Cumulative Reports Over Time

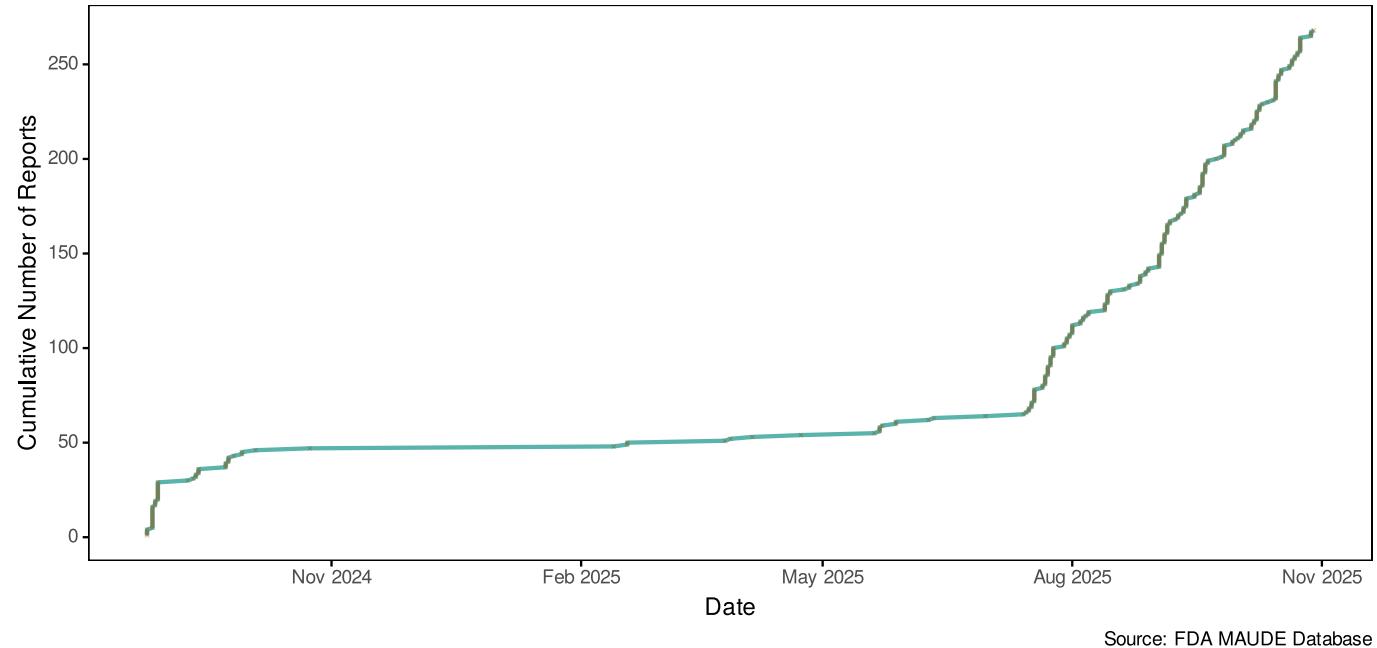
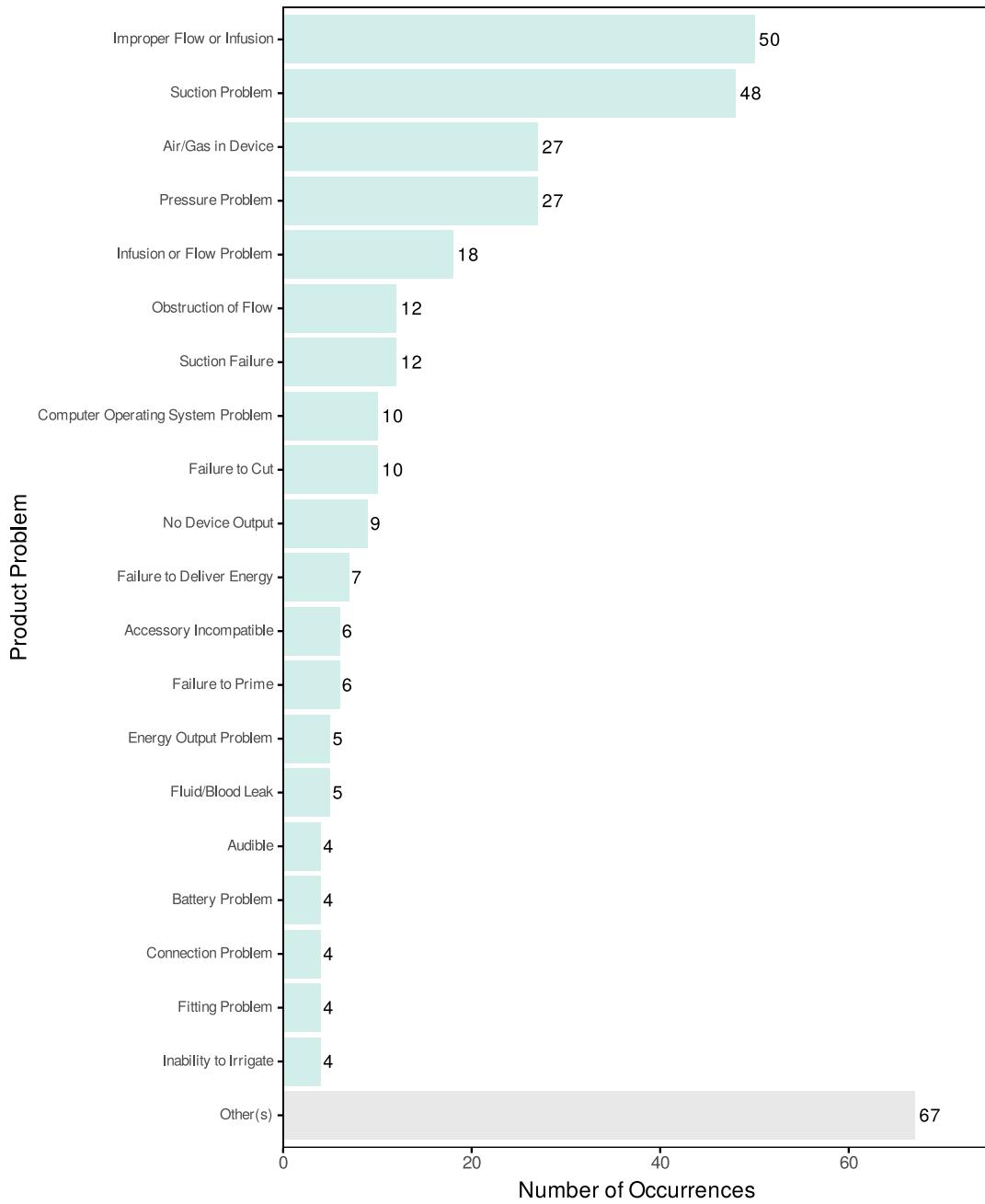


Figure 2: Cumulative FDA MAUDE reports over time

## 4. Product Problem Analysis

### 4.1. Product Problems Analysis

(August 2024 - October 2025)



Source: FDA MAUDE Database | Note: Reports may contain multiple problems

Figure 3: Product problems representing approximately 80% of problem occurrences (80.2%), plus 'Other(s)' category

A total of **20** product problem type(s) account for **80.2%** of all reported problem occurrences (**272** occurrences).

The remaining **67** problem occurrences (**19.8%**) are categorized as “Other(s)”.

**All Product Problems Representing 80.2% of Data:**

1. **Improper Flow or Infusion** - 50 occurrences (14.7%)
2. **Suction Problem** - 48 occurrences (14.2%)
3. **Air/Gas in Device** - 27 occurrences (8.0%)
4. **Pressure Problem** - 27 occurrences (8.0%)
5. **Infusion or Flow Problem** - 18 occurrences (5.3%)
6. **Obstruction of Flow** - 12 occurrences (3.5%)
7. **Suction Failure** - 12 occurrences (3.5%)
8. **Computer Operating System Problem** - 10 occurrences (2.9%)
9. **Failure to Cut** - 10 occurrences (2.9%)
10. **No Device Output** - 9 occurrences (2.7%)
11. **Failure to Deliver Energy** - 7 occurrences (2.1%)
12. **Accessory Incompatible** - 6 occurrences (1.8%)
13. **Failure to Prime** - 6 occurrences (1.8%)
14. **Energy Output Problem** - 5 occurrences (1.5%)
15. **Fluid/Blood Leak** - 5 occurrences (1.5%)
16. **Audible** - 4 occurrences (1.2%)
17. **Battery Problem** - 4 occurrences (1.2%)
18. **Connection Problem** - 4 occurrences (1.2%)
19. **Fitting Problem** - 4 occurrences (1.2%)
20. **Inability to Irrigate** - 4 occurrences (1.2%)

## 5. Patient Problem Analysis

### 5.1. Patient Problems Analysis

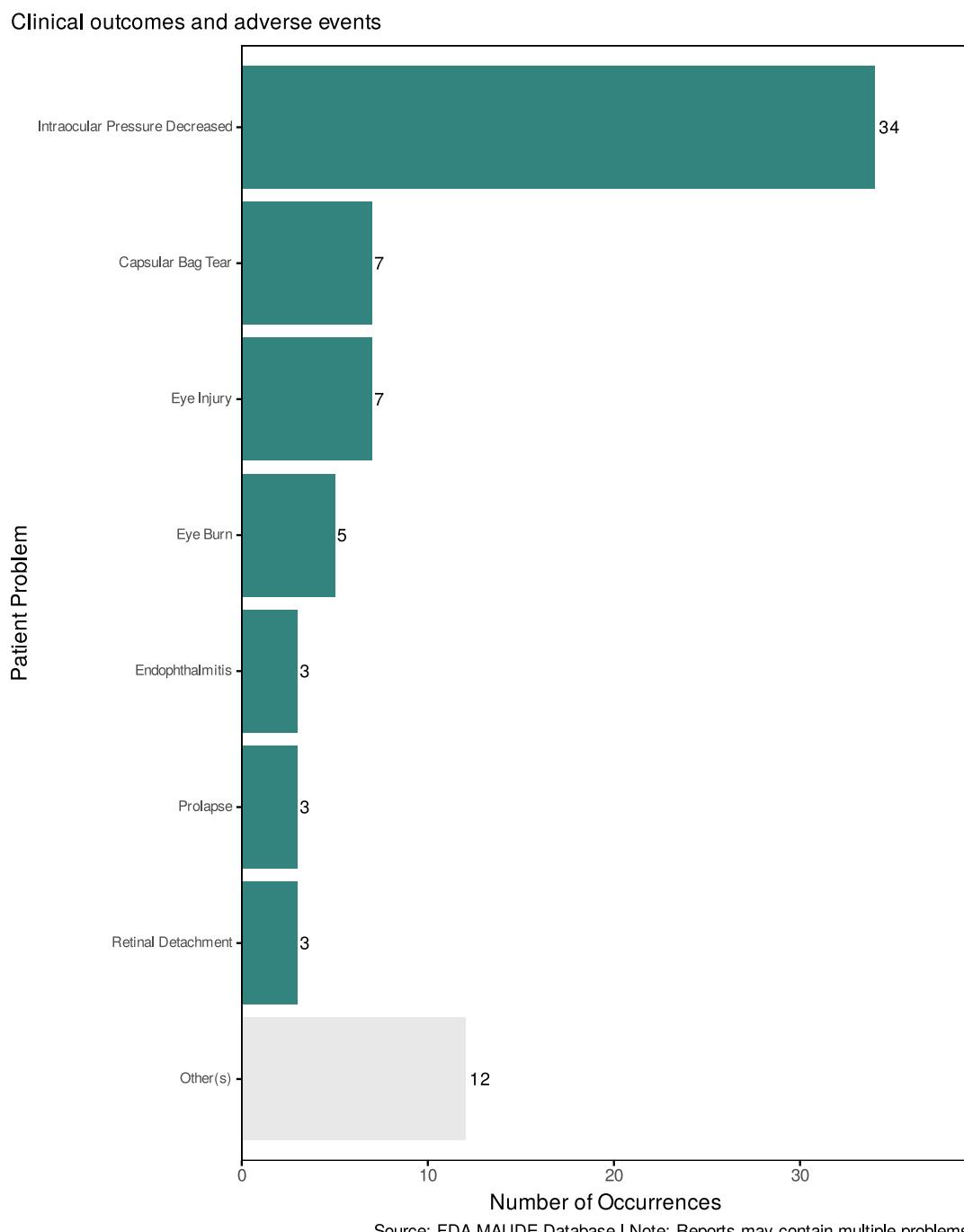


Figure 4: Patient problems representing approximately 80% of problem occurrences (83.8%), plus 'Other(s)' category

A total of **7** patient problem type(s) account for **83.8%** of all reported patient problem occurrences (**62** occurrences).

The remaining **12** problem occurrences (**16.2%**) are categorized as “Other(s)”.

#### All Patient Problems Representing 83.8% of Data:

1. **Intraocular Pressure Decreased** - 34 occurrences (45.9%)
2. **Capsular Bag Tear** - 7 occurrences (9.5%)
3. **Eye Injury** - 7 occurrences (9.5%)
4. **Eye Burn** - 5 occurrences (6.8%)
5. **Endophthalmitis** - 3 occurrences (4.1%)
6. **Prolapse** - 3 occurrences (4.1%)
7. **Retinal Detachment** - 3 occurrences (4.1%)

## 6. Manufacturer Analysis

### 6.1. Top Manufacturers

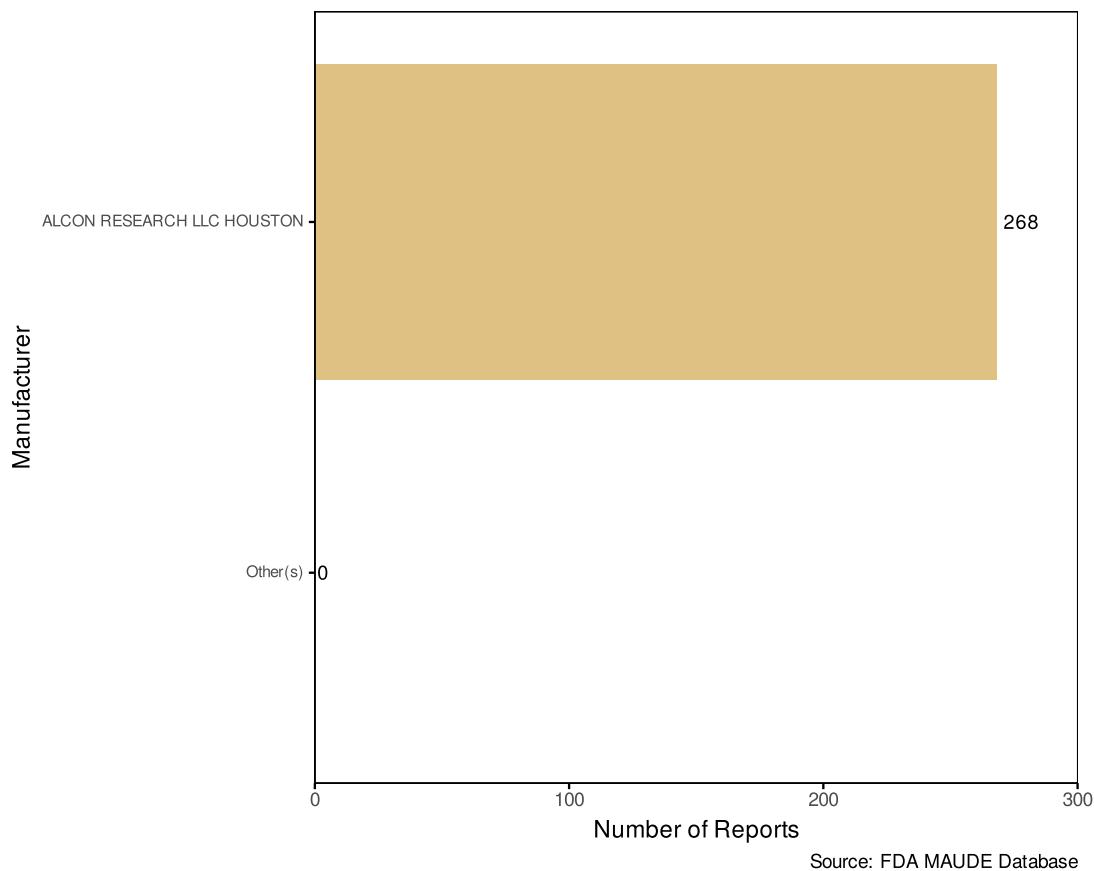


Figure 5: Manufacturers representing approximately 80% of reports (100%), plus ‘Other(s)’ category

A total of **1** manufacturer(s) account for **100%** of all reports (**268** reports).

The remaining **0** reports (**0%**) are from other manufacturers.

The top manufacturer, **ALCON RESEARCH LLC HOUSTON**, accounts for **268** reports (**100%** of total).

Table 2: Manufacturer(s) representing 100% of reports

Rank	Manufacturer	Reports	% of Total
1	ALCON RESEARCH LLC HOUSTON	268	100.00%

## 7. Device Brand Analysis

### 7.1. Top Device Brands

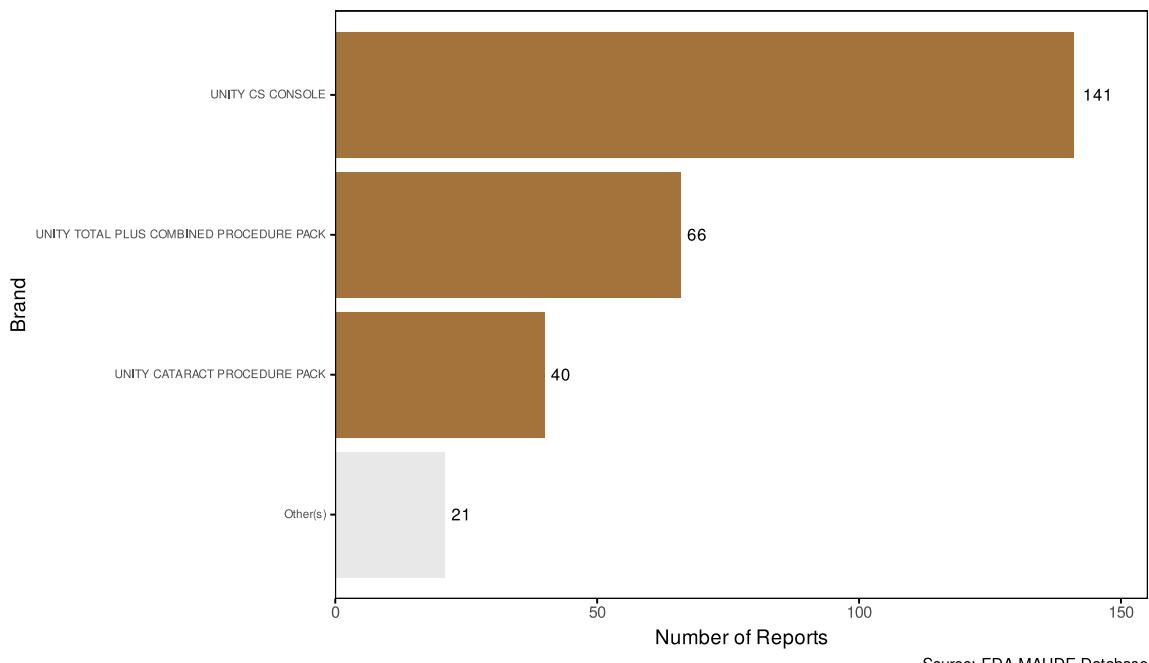


Figure 6: Device brands representing approximately 80% of reports (92.2%), plus ‘Other(s)’ category

A total of **3** device brand(s) account for **92.2%** of all reports (**247** reports).

The remaining **21** reports (**7.8%**) are from other brands.

The top device brand, **UNITY CS CONSOLE**, accounts for **141** reports (**52.6%** of total).

Table 3: Device brand(s) representing 92.2% of reports

Rank	Brand	Reports	% of Total
1	UNITY CS CONSOLE	141	52.61%
2	UNITY TOTAL PLUS COMBINED PROCEDURE PACK	66	24.63%
3	UNITY CATARACT PROCEDURE PACK	40	14.93%

## 7.2. Brand Temporal Trends

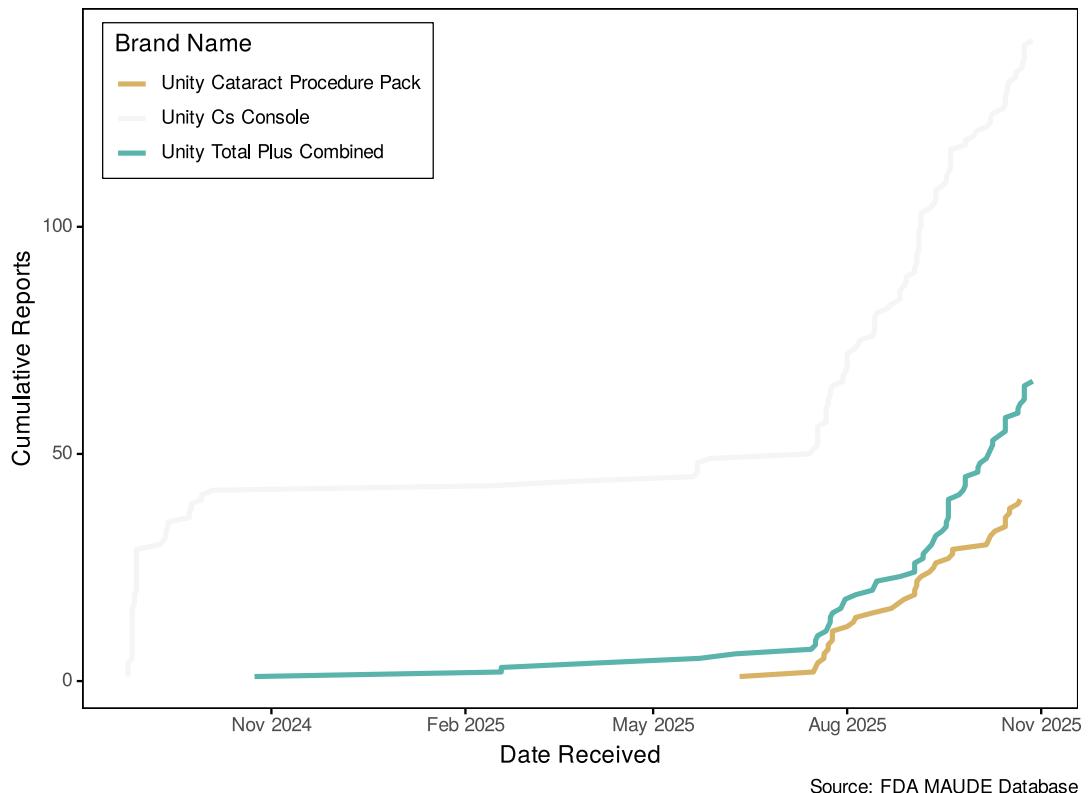


Figure 7: Cumulative adverse event reports by top 5 brands

## 8. Technical Appendix

### 8.1. Data Source

- **Database:** OpenFDA Medical Device Adverse Events
- **API Access:** <https://open.fda.gov/apis/device/event/>

## 8.2. Analysis Tools

- **Python 3.x** with pandas and rapidfuzz for data processing
- **R** with tidyverse, ggplot2, and lubridate for visualization
- **Fuzzy Matching:** RapidFuzz library for text standardization
- **Visualization:** ggplot2 with custom base R theme
- **Report Generation:** Quarto for reproducible analytics

## 8.3. Exclusion Criteria

### Patient Problems Excluded:

- No Code Available
- No Known Impact Or Consequence To Patient
- Symptoms or Conditions
- No Information
- No Consequences Or Impact To Patient
- Appropriate Clinical Signs
- No Clinical Signs
- Conditions Term / Code Not Available
- Appropriate Term / Code Not Available
- Insufficient Information
- No Patient Involvement
- Reaction
- Patient Problem/Medical Problem

### Product Problems Excluded:

- Adverse Event Without Identified Device or Use Problem
- Appropriate Term/Code Not Available
- Appropriate Term / Code Not Available
- Unknown (for use when the device problem is not known)
- Insufficient Information
- No Apparent Adverse Event

## 8.4. Report Metadata

- **Generated:** 2025-11-20 12:30:44
- **Dataset Version:** 2025-10-29
- **Total Records Analyzed:** 268
- **Analysis Pipeline:** OpenFDA Medical Device Adverse Event Analysis v2.1

## List of Figures

Figure 1 Monthly trend of FDA MAUDE reports .....	4
Figure 2 Cumulative FDA MAUDE reports over time .....	6
Figure 3 Product problems representing approximately 80% of problem occurrences (80.2%), plus 'Other(s)' category .....	7
Figure 4 Patient problems representing approximately 80% of problem occurrences (83.8%), plus 'Other(s)' category .....	9
Figure 5 Manufacturers representing approximately 80% of reports (100%), plus 'Other(s)' category .	10
Figure 6 Device brands representing approximately 80% of reports (92.2%), plus 'Other(s)' category .	11
Figure 7 Cumulative adverse event reports by top 5 brands .....	12

## List of Tables

Table 1	Summary statistics of FDA MAUDE reports .....	2
Table 2	Manufacturer(s) representing 100% of reports .....	11
Table 3	Device brand(s) representing 92.2% of reports .....	12