Medical Device Quality & Risk Analytics Dashboard

Tool: Power BI
Database: MySQL
Data Source: Quality & Device Risk Views
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Executive Summary

This Power BI dashboard provides a comprehensive analytical view of medical device quality performance and operational risk. The solution integrates defect tracking, repair cost analysis, device-level risk scoring, and operational downtime monitoring into an interactive reporting environment.

Key insights from the analysis:

- **1,000 total defects** were recorded, with **333 classified as critical (33%)**.
- Total repair costs exceeded **$507K**, with an average repair cost of approximately **$507 per defect**.
- Devices show measurable correlation between **failure events and downtime**, enabling quadrant-based risk segmentation.
- The highest risk devices contribute disproportionately to operational downtime and maintenance expenses.
- Device-level drill-through allows granular inspection of risk score, failure frequency, downtime, and maintenance class distribution.

This dashboard enables quality managers and operational leaders to:

- Monitor defect trends
- Identify high-risk devices
- Understand repair cost drivers
- Segment operational risk
- Take proactive maintenance decisions

PAGE 1 — Quality Performance Overview

Purpose

To monitor defect trends, critical defect ratio, and repair cost patterns over time.

I Cards

1.Total Defects
Metric: Sum of total_defects
Value: 1,000
Insight:
Provides a macro-level view of product quality performance. This is the baseline for all downstream analysis.

2.Critical Defects
Metric: Sum of critical_defects
Value: 333
Insight:
Critical defects represent high-severity failures requiring urgent remediation.

3.Critical %
Metric: Critical Defect Rate
Formula:
Critical % = Critical Defects / Total Defects
Value: 33%
Insight:
Approximately one-third of all defects are critical, indicating significant severity exposure and potential regulatory risk.

4.Total Repair Cost
Metric: Sum of total_repair_cost
Value: $507.63K
Insight:
Total financial impact of defects. Useful for cost containment and budgeting.

5.Average Repair Cost
Metric: Average of avg_repair_cost
Value: ~$507
Insight:
Represents average repair cost per defect. Stable trends indicate consistent repair complexity.

II Monthly Defect Trend (Line Chart)

X-Axis: year_month
Y-Axis:

- Sum of total_defects
- Sum of critical_defects

Purpose:
Track defect volume and severity trend over time.

Key Observations:

- January shows the highest total defect count (~191).
- Gradual stabilization observed toward mid-year.
- Critical defect pattern closely follows total defect trend → strong correlation.

Business Value:

- Helps detect seasonal spikes.
- Enables early intervention when defect rates increase.

II Monthly Repair Cost Trend (Area Chart)

X-Axis: year_month
Y-Axis: Sum of total_repair_cost

Insight:

- Highest repair costs observed in early months.
- Declining trend suggests improved quality controls or operational efficiency.

Business Interpretation:

- Reduced repair cost over time may indicate corrective action effectiveness.
- Can be tied to process improvements.

III Executive AI Summary (Smart Narrative)

Automatically generated dynamic insights based on:

- Highest defect month
- Lowest defect month

- Defect contribution percentage
- Correlation observations

Purpose:
Provide executive-ready commentary without manual analysis.

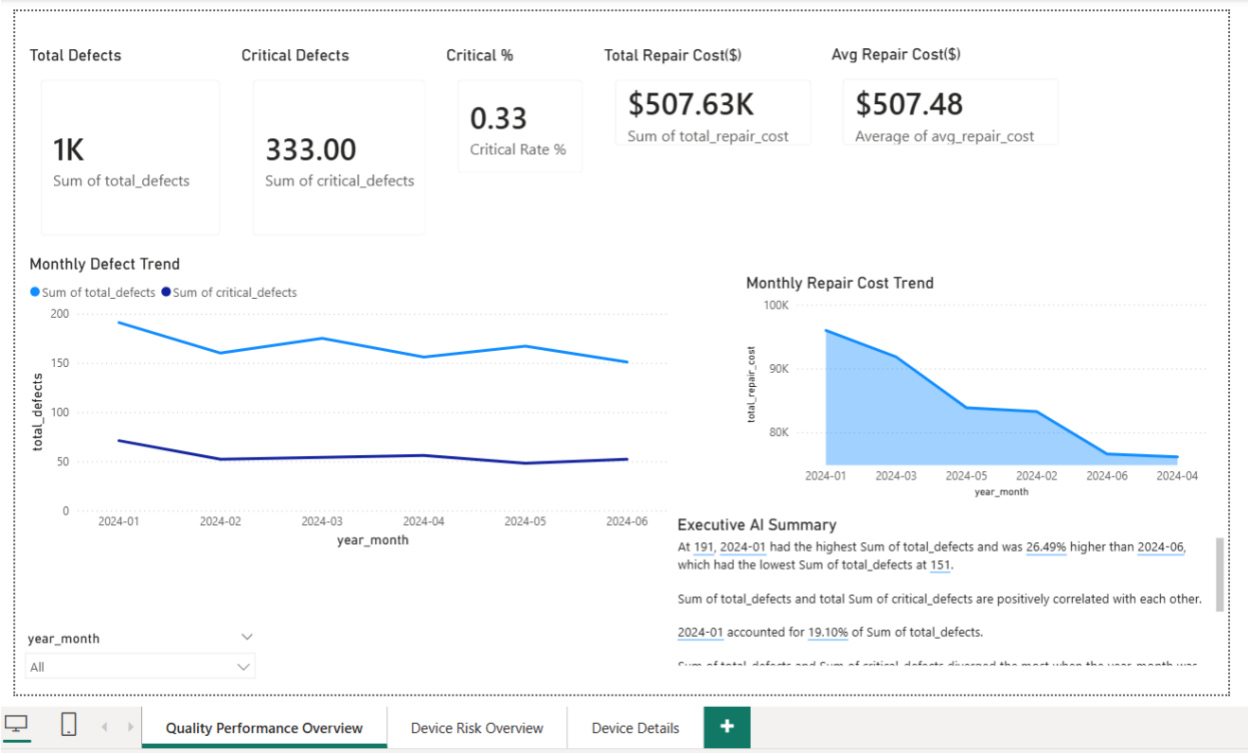


Fig 1: Page 1(Quality Performance Overview)

PAGE 2 — Device Risk Overview

Purpose

Identify high-risk devices, analyze operational impact, and segment risk behavior.

I **Cards**

1.Total Devices
Metric: Count of device_id
Value: 4.149K
Represents total device population under monitoring.

2.Average Risk Score
Metric: Average of risk_score
Value: 29.05
Provides overall portfolio risk level.

3.Total Maintenance Cost

Metric: Sum of maintenance_cost
Value: $35.86M
Shows long-term operational maintenance burden.

4.Total Downtime
Metric: Sum of downtime
Value: 44.07K
Critical for operational availability tracking.

II Top 10 High Risk Devices (Bar Chart)

Axis: device_id
Metric: Sum of risk_score

Insight:

- Identifies devices contributing most to risk exposure.
- Concentrated risk distribution suggests a few devices drive most risk.

Business Action:

- Prioritize inspection & preventive maintenance for top devices.

III Risk by Device Type (Bar Chart)

Axis: device_type
Metric: Average risk_score

Insight:

- Compares device categories (CT Scanner, Defibrillator, etc.).
- Detects structurally high-risk device types.

Strategic Use:

- Informs procurement decisions.
- Supports vendor performance evaluation.

IV Failure vs Downtime Analysis (Scatter Plot)

X-Axis: Average of failure_event_count
Y-Axis: Average of downtime
Legend: device_type

Includes:

- X-axis constant line (Average failures)
- Y-axis constant line (Average downtime)
- Quadrant labels:
    - Low Risk Zone
    - Failure Driven Risk
    - Downtime Driven Risk
    - High Operational Risk

Quadrant Interpretation

Quadrant	**Meaning**	**Action**
Low Risk Zone	Low failures, Low downtime	Monitor
Failure Driven Risk	High failures, Lower downtime	Maintenance scheduling
Downtime Driven Risk	Low failures, High downtime	Process bottleneck
High Operational Risk	High failures, High downtime	Immediate escalation

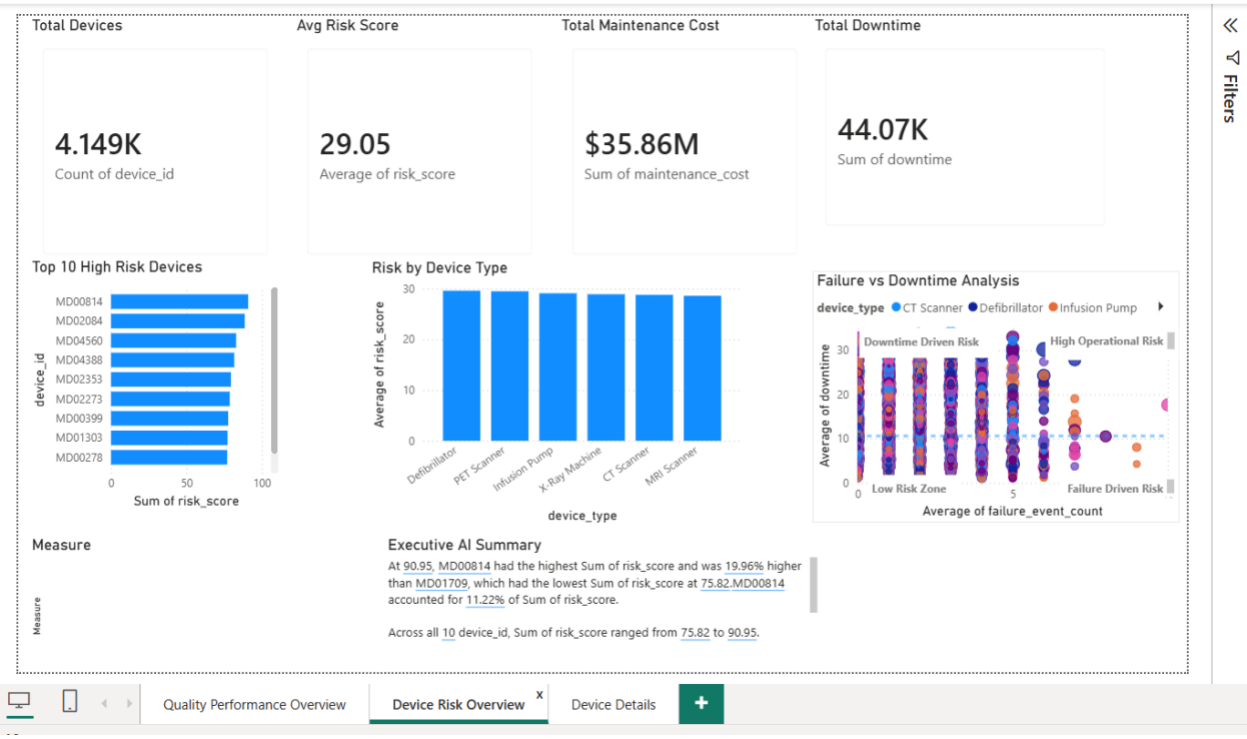
Insight:
Devices in the top-right quadrant represent operational threats requiring urgent intervention.

V Executive AI Summary (Page 2)

Highlights:

- Highest risk device
- Risk score distribution range
- Contribution of top device to overall risk

Provides executive-level commentary automatically.



PAGE 3 — Device Detail Analysis (Drill Through)

Purpose

Deep-dive analysis for a selected device from Page 2.

Device ID Filter

Selected via drill-through from scatter plot or top risk list.

Device KPIs

Metric	Description
Risk Score	Aggregated risk value
Failure Event Count	Total failures recorded
Downtime	Total downtime
Maintenance Cost	Total maintenance expense

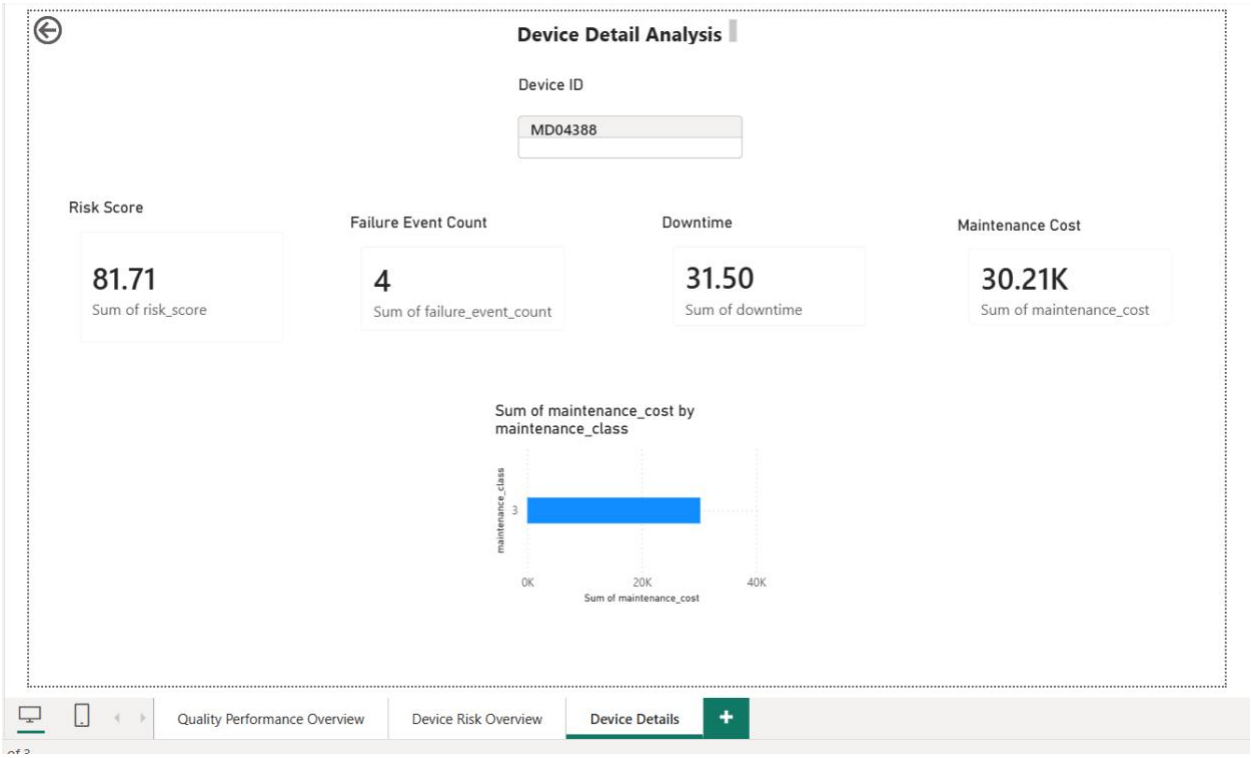
Maintenance Cost by Class (Bar Chart)

Axis: maintenance_class
Metric: Sum of maintenance_cost

Insight:
Shows distribution of maintenance expenditure across maintenance types.

Business Value:

- Identifies if cost is driven by reactive or preventive maintenance.
- Helps optimize maintenance strategy.



Data Architecture

Source Database

Kaggle Datasets:

[Manufacturing Defects]

[Medical Device Failure Dataset – (Anonymized)]

MySQL database quality_analytics

Views Used

1. vw_defects_monthly
    - year_month
    - total_defects
    - critical_defects
    - total_repair_cost
    - avg_repair_cost
2. vw_device_risk_summary
    - device_id
    - device_type
    - risk_score
    - failure_event_count
    - downtime
    - maintenance_cost
    - maintenance_class

Business Impact

This dashboard enables:

- Proactive defect monitoring
- Risk-based device prioritization
- Financial impact visibility
- Operational downtime analysis
- Executive-level reporting automation

Skills Demonstrated

- SQL View Creation
- Data Modeling
- DAX Measures
- Risk Segmentation Logic
- Drill-Through Implementation
- Smart Narrative (AI Integration)
- Quadrant Analysis
- Executive Dashboard Design