

Patient Electronic Health Record Accessibility Optimization with root-cause analysis in a Medical Center of Taiwan—A Digital ECGs Uploading study

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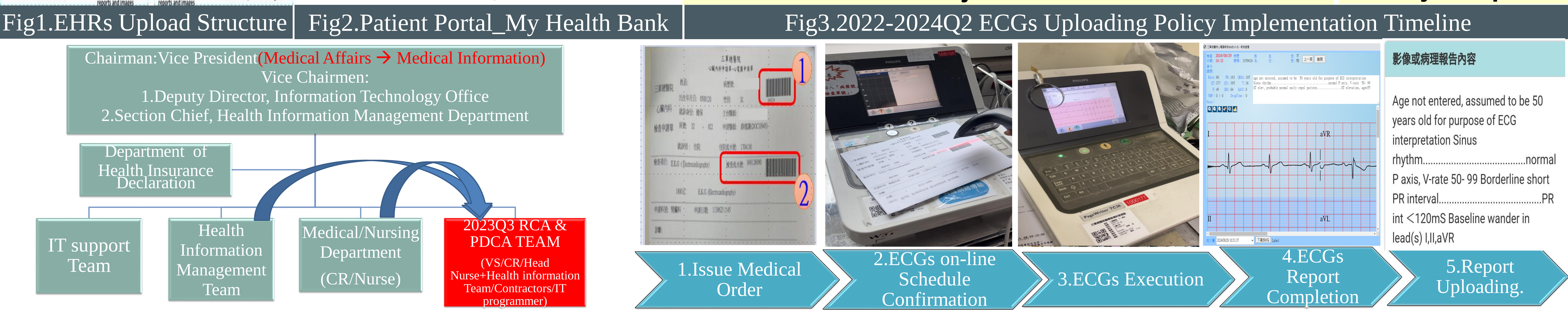
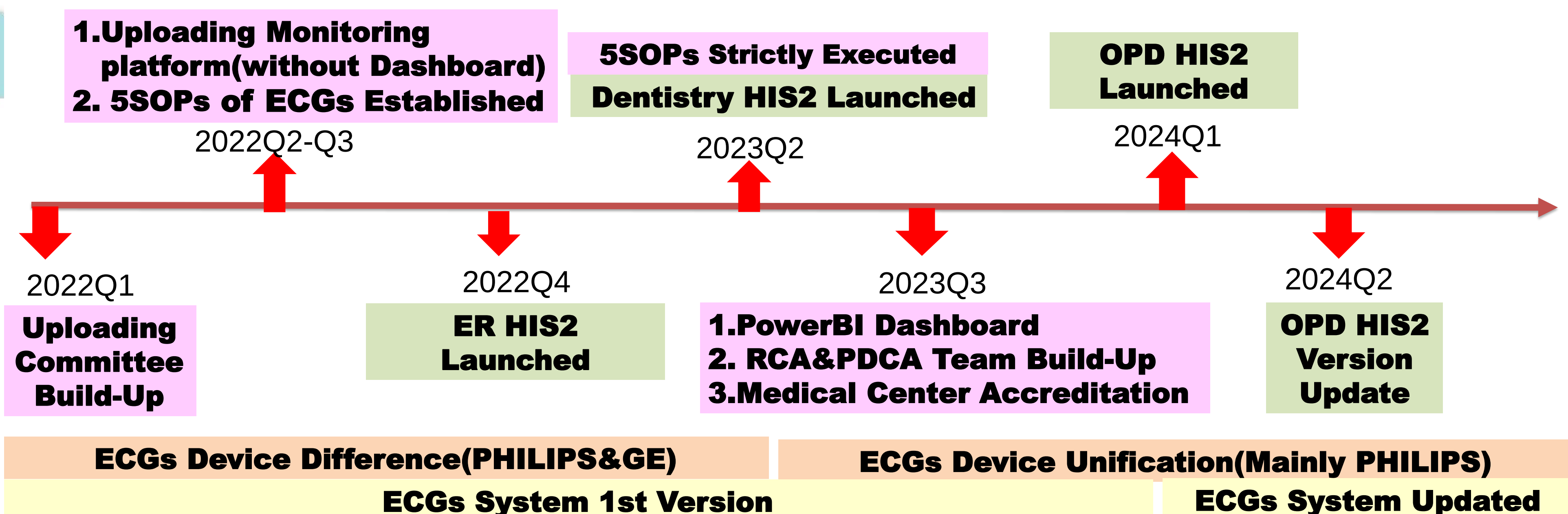
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Introduction

Patient-Accessible Electronic Health Records(PAEHRs) are digital versions of patients’ medical records which containing lab test, exam reports, medical images, outpatient medical records and discharge summaries etc.The goal is let patients easily gain access to their own health information and share decision making.Taiwan Ministry of Health and Welfare(MOHW)White paper 2025 points out one of key objectives is to optimize EMR Interoperability (Fig1.EHRs Upload Structure) and PAEHRs Accessibility(Fig2.Patient Portal_My Health Bank) for better healthcare. However, human error, HIS Revision, incompatible interface make uploading data to MOHW Cloud platform more difficult. Compared to other exams, we had poor uploading ratio of ECGs report in 2022Q1(38%).We would like to evaluate uploading workflow by Root-Cause Analysis for optimizing PAEHRs.(Timeline is shown as Fig3).

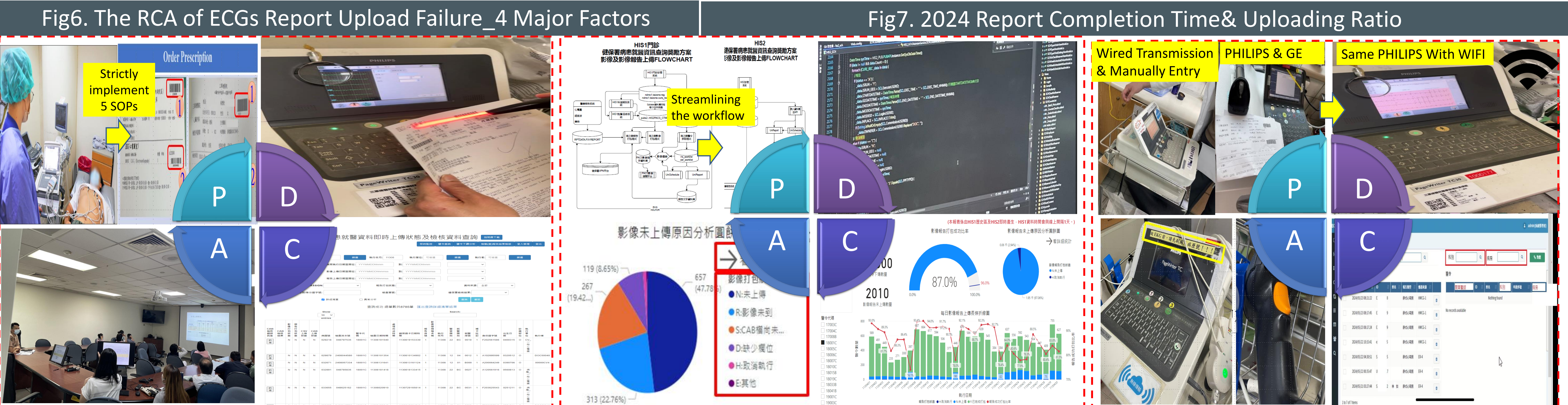
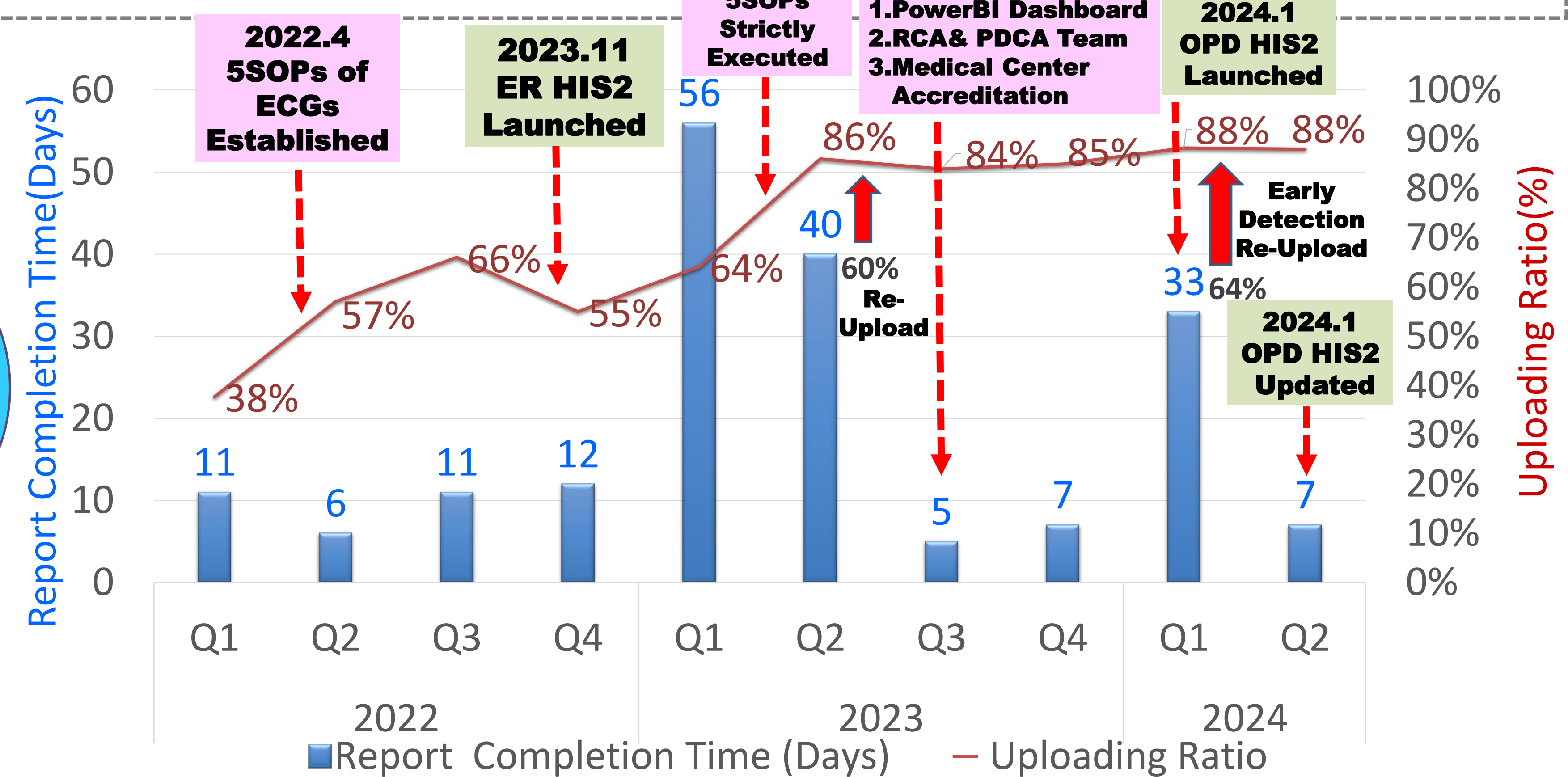
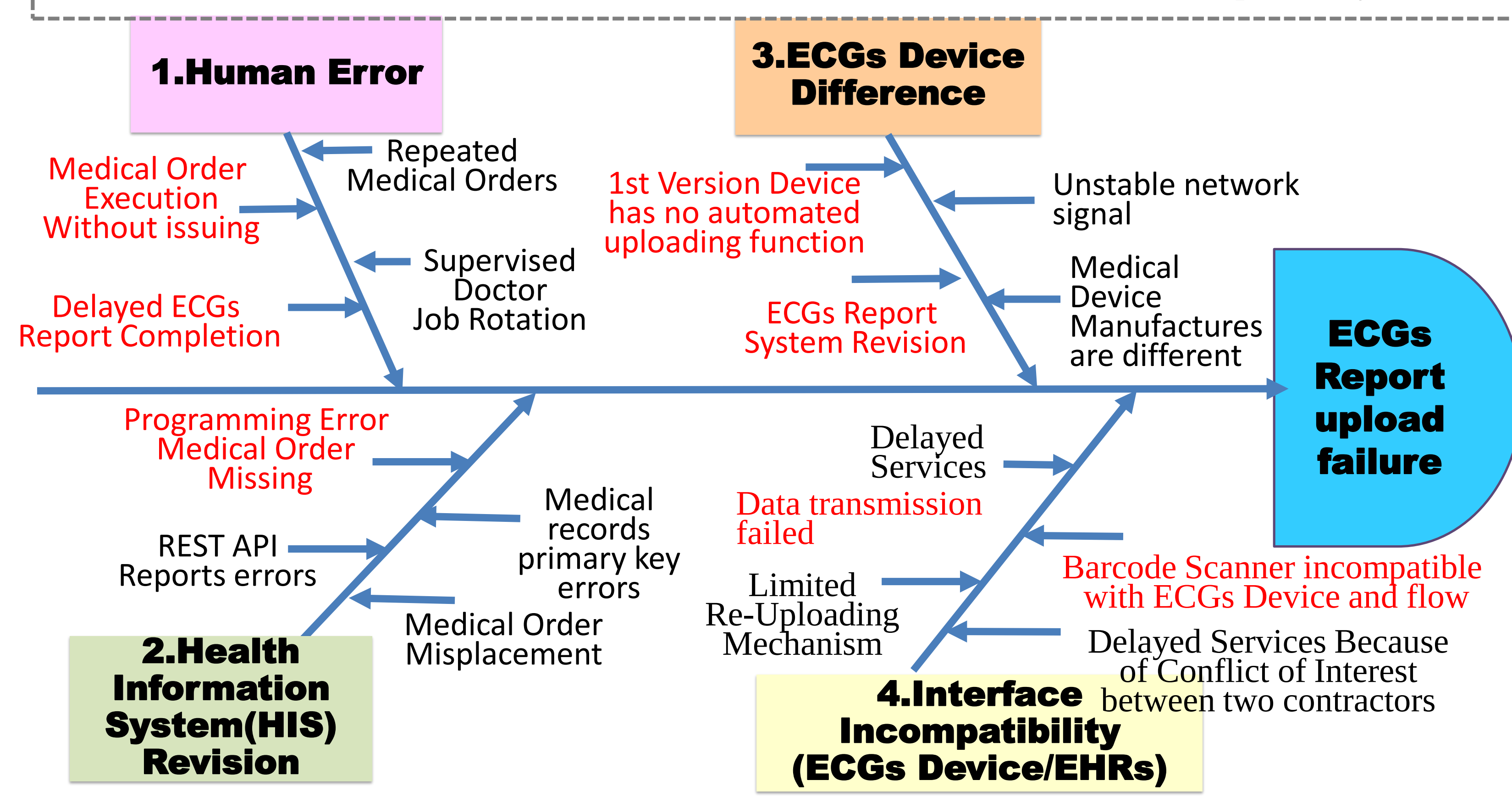
Methods

We established PAEHRs Uploading Committee(Fig4) in 2022 Q1 and collected digital electrocardiograms (ECGs) report data from 2022 Q1 to 2024 Q2,then employed Root Cause Analysis (RCA) to pinpoint causative factors with Ishikawa Diagram.In 2023Q2-Q3,we executed 5SOPs(Fig5) strictly and applied Plan-Do-Check-Act (PDCA) Model for uploading improvement. We evaluate the performance(How many and How fast could patients approach Patient Portal-My Health Bank?)by uploading ratio and report completion time.



Result

The RCA found four major factors(Ishikawa Diagram Fig6): Human Error, Health Information System(HIS)Revision, ECGs Device Difference, Interface Incompatibility. The quarterly average uploading ratio of ECGs report increased from 38%(2022 Q1) to 88%(2024 Q2),and Report Completion Time shortened from 56 days(2023 Q1) to 7 days(2024 Q2)(Fig7). It means more patients could access to their EHR in a shorter period of time. The annual ECGs failed uploading ratio was dropped from 25.2%(26,994/107,060) to 19.1%(21,085/110,252) from 2022 to 2023,and reached a record low 12.7%(6,937/54,585) in first half of 2024.The percentage of Human Error factor was decreased from 48.9% (13,204/26,994) in 2022 to 15.7%(3,178/21,085) in 2023 after PDCA (Fig8) and 5SOPs execution. However, compared to 2022(21.1%), HIS Revision factor rose to 54.3% in 2023,46.8% in 2024Q1 and declined to 15% in 2024 Q2. ECGs Device Difference and Interface Incompatibility remained around 14%-20% from 2022 to 2024.



2022 VS.2023 Human Error
Medical Order Execution without Issuing(48.9%→15.7%)

2022 VS. 2023 VS. 2024Q2 OPD HIS2 Launch
Programming Error Medical Order Missing(21.1→54.3%→15%)

2022 VS. 2024 ECGs Device Unification (19.8%→14%)
2022 VS. 2024 Interface Compatibility(15.5%→18.6%)

Fig8. Plan-Do-Check-Act

Conclusion

Early Intervention Monitoring and Preparation are important, including:1.Cross-Functional Team Build-Up(Health Information Manager, Doctors and ECGs Technician, IT Programmer,Insurance Declarer and Contractors). 2.HIS revision quick response for debugging program 3.EHR Accessibility Indicator set-up (Uploading Ratio,ECGs Report Completion Time).Overall, 2023 Q3 upload ratio is 84% (without re-upload) which exceeded 80% for the first time and ECGs report could be reached within 5 days for better PAEHRs. There are some data transmission delay because of OPD HIS2 launch in 2024 Q1.Even though, the Uploading Ratio and Report Completion Time reached 88% and 7days respectively after program error correction and ECGs system integration. The constant SOPs execution and HIS stabilization and ECGs system integration are the key elements to reach the last mile.