PEDSnet DQA Tutorial

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Roadmap

• Background on our process
• Overview of how to run our DQA
• DQA file structure and content
• Example output from our DQA
• Current goals
Background
Our Use Case

• PEDSnet has integrated our DQA program into our data pipeline. We view it as essential to data standardization, the evolution of the PEDSnet CDM, and benchmarking goals

• Our institution receives data from our 7 constituent hospitals on a quarterly basis

• We continue to adapt our DQA to our evolving needs
PEDSnet Data Quality Process Overview

Site EHR → Data Extraction Process → Site data For PEDSnet → PEDSnet DQ Cycle
- DQ Issue Warehouse
  - Apply DQ checks
  - 250+ variables

PEDSnet DQ Cycle
- Prepare feedback
  - presentation
- new vs. persistent issues

Site ETL Team → Data Evolution for PEDSnet → PCORnet specifications → Data Characterization
Current Workflow

- Sites run ETL and data is securely transferred to our site

- We upload that data to our local database and run our DQA toolkit

- Our goal is to create GitHub issues to facilitate a brief, focused conversation with each site’s ETL analysts, for each issue
  - Need to avoid issue fatigue
Feedback from DQA

• The cause of each issue is labeled as ETL, persistent (characteristic), an improvement, or a workflow error along with an appropriate cause label.

• Rank-order using low, medium, and high importance.

• ETL analysts work with the PEDSnet DCC to unravel each issue to see whether ETL can be reworked to improve the result.

PEDSnet: A Pediatric Learning Health System
Rank and Cause Distribution
*v3.0 Submission*

- High = Major ETL issues
- Medium = characteristic issues + minor ETL issues
- Low = Improvements over previous ETL
Running the PEDSnet DQA
Cloning the Repository

• Go to https://github.com/PEDSnet/Data-Quality-Analysis click “clone” to copy the provided link, enter “git clone” and that link in your terminal

• This is a public repository that is updated regularly

• Currently supports Oracle and PostgreSQL databases
Install Necessary Packages

- Below the code links in the GitHub repository is a link of packages that need to be installed for the DQA to work.

- Our DQA utilizes an R package developed by Dr. Charles Bailey at CHOP called ‘Argos’ which streamlines our database connections using a .json file.

- The package extensively uses the tidyverse via the ‘dplyr’ package.
Prepare the Configuration Files

• From the top directory, go to ‘Resources’ and open ‘PEDSnet_config.yml’ and add information relating to your database connection, output directory, CDM version, etc.

• Create an argos directory (preferably a hidden .argos directory) and add your argos configuration .json
  • This is outlined on the repository
Run the DQA

• Set your working directory to the top directory of the package

• Source the ‘Run_DQA.R’ file in this directory
  • Can run a single report with generateSingleReport()
  • Can run all reports with runDQA()

• Any errors or printed information will be recorded in the file ‘dqa.log’ in the top directory
DQA Structure & Content
Data Directory

- The data directory is split into three subdirectories by use case
  - The PreviousDataSummary folder contains data from the previous data cycle that is used in comparison checks
    - e.g. did the total number of inpatient visits change significantly?
  - The DQACatalog folder contains an inventory of check information that is read in every time a check is run
    - e.g. threshold values and a brief description of the check for the ETL analyst
  - The ValueSets directory contains table-specific information for checks
    - e.g. what filtering conditions should be used or what are the accepted procedure_type_concept_ids
Library

• The library directory contains a script for each of the checks that our DQA implements.

• This directory also includes functions for database operations in the script “PerformDatabaseOperations.R” which executes queries to produce specific data frames used in checks and reports.
  • By putting generalized queries in this file, we avoid updating each check.

• Various plots are also produced using functions from the “CreatePlots.R” file.
Example Plot: Visit_start_date Monthly Count
Main Directory

• The main directory is split into two levels
  • Level 1 focuses on univariate checks
  • Level 2 focuses on checks that utilize multiple tables with foreign keys

• Within each level is a series of report functions that implement all checks around a given table
Example Output
Results

• Results directory will now have the DQA output spread through four separate subdirectories

• Data directory includes summary information used for the DQA process such as ‘total_counts.csv’ as well as records such as ‘top_inpatient_drugs.csv’ which are used for issue generation

• Images directory contains all images generated while the report directory contains summary markdowns, including those images
Issues

• The ‘issues’ directory includes a list of issues found by the DQA that for each domain

• Issues are copied and summarized in GitHub using a Go Language program that can recognize if an issue should be reposted or updated based on GitHub labeling

• We want to discuss all new issues at hand while avoiding fatigue with sites by reposting resolved or characteristic issues
Examples

• Illegal vocabulary in condition table:
  • https://github.com/PEDSnet/CHOP/issues/758

• Unexpected drop in visit payer records between data cycles:
  • https://github.com/PEDSnet/CHOP/issues/752

• Pre-Birth visits:
  • https://github.com/PEDSnet/CHOP/issues/690

• Unexpected Change in number of outpatient visits:
  • https://github.com/PEDSnet/CHOP/issues/731

• Temporal Outliers due to flu season:
  • https://github.com/PEDSnet/CHOP/issues/636
Current Goals
DQA Continues to Evolve

• Each data cycle (quarter), our data quality package adapts to our needs and standards

  • Improve checks based on stakeholder feedback

  • Add new fields and reports based on information added to PEDSnet CDM

  • Design new checks based on ongoing findings in our data
Expanding DQA Scope

- We are currently looking to add metadata collection to our data quality process

- This will involve recording information from each check each time the program is run

- This could provide further insight into how our DQA is performing overall, how sites have evolved over time based on feedback, and open avenues for statistical investigation of data quality
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