



Dashboard Development

A PRIMER

Patient Care Intervention Center

3701 KIRBY DR. HOUSTON TX 77098 | SUPPORT@PCICTX.ORG

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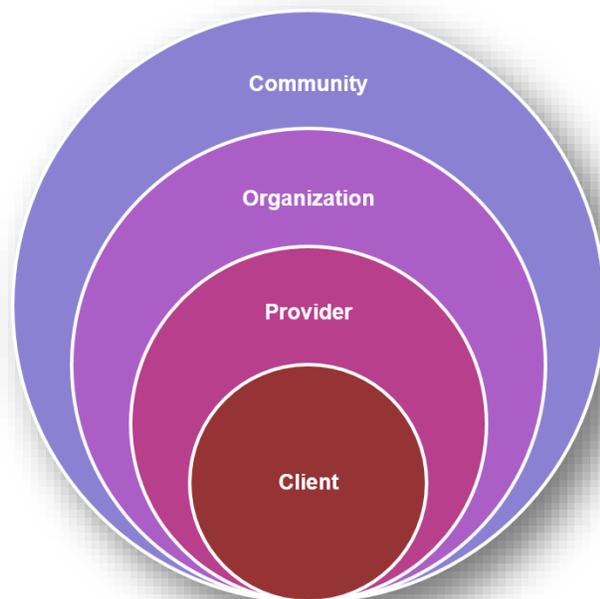
INTRODUCTION

The United States spends \$2.8 trillion on healthcare every year. \$1.4 trillion of this, or 50%, is attributed to only 5% of the population - a population known by the ironic term, super utilizers. In Texas, 1% of the population consumes 24% of the costs, which is 50% higher than the national figures. In Harris County, the Top 1%, or 6,000, super utilizers, consumed \$806 million in 2011. The mission of Patient Care Intervention Center (PCIC) is to improve healthcare quality and costs for the vulnerable in our community through data integration and care coordination. A driving factor in this process is the development of dashboards to help in identifying the most vulnerable in our systems. Much effort is being made at the individual institutional level for each entity's super utilizer populations, but very little is being done as a collective. A characteristic of super utilizers is that they seek care from many health and social institutions. Community-wide programs can address these individuals more effectively by applying a comprehensive, evidenced-based approach, like Assertive Community Treatment (ACT) teams for the chronically homeless. ACT teams use intensive care coordination across many specialties.

OVERVIEW OF PCIC

PCIC works across Harris County's health systems to identify and coordinate care for super utilizers; to decrease their emergency department and hospital utilization and cost; and to improve their health and quality of life. Building data structures, dashboards, and overlap analysis enables a more comprehensive picture of super utilizers and defines the safety net needed to support improvements in their health and the health of our community.

PCIC has developed a variety of types or categories of dashboards for its stakeholders and partners, with some examples being: "Super Utilizer Identification Dashboards," "Patient Selection Dashboards," "Cost Analysis Dashboards," "Patient Tracking Dashboards," and "Business Process Improvement Dashboards." These dashboards are designed to serve specific purposes and meet organizational and business needs.



The majority of dashboards developed by PCIC are designed at the patient, provider, or organization level, and for the most part is "silo" based analysis. To truly understand the needs of an entire community we need to start working across systems, overlapping data from multiple sources and developing dashboards at the community level.

The solution to this "silo based" model is the development of a Community Health Council that convenes a data-sharing and analytics platform across systems and institutions. The Community Health Council and its leadership will drive and provide guidance to the efforts around **integrated** data sharing, **integrated** data analysis, and community dashboards (For additional information on the Community Health Council, please contact PCIC.) In this document we look at dashboards and

the steps involved in developing useful dashboards, so that that they align to your organization's needs and goals.

DASHBOARDS

In this section we look at dashboards: What they are, how they can be used and the different kinds of dashboards that PCIC develops. We will also look at some examples of dashboards.

WHAT ARE DASHBOARDS?

A dashboard is a platform where multiple visuals or graphs are combined in a single interface, optionally linking together the visuals to provide an interactive experience to the end user. Dashboards enable data to be visually presented to help better understand the data, provide for actionable intelligence, and help in decision making.

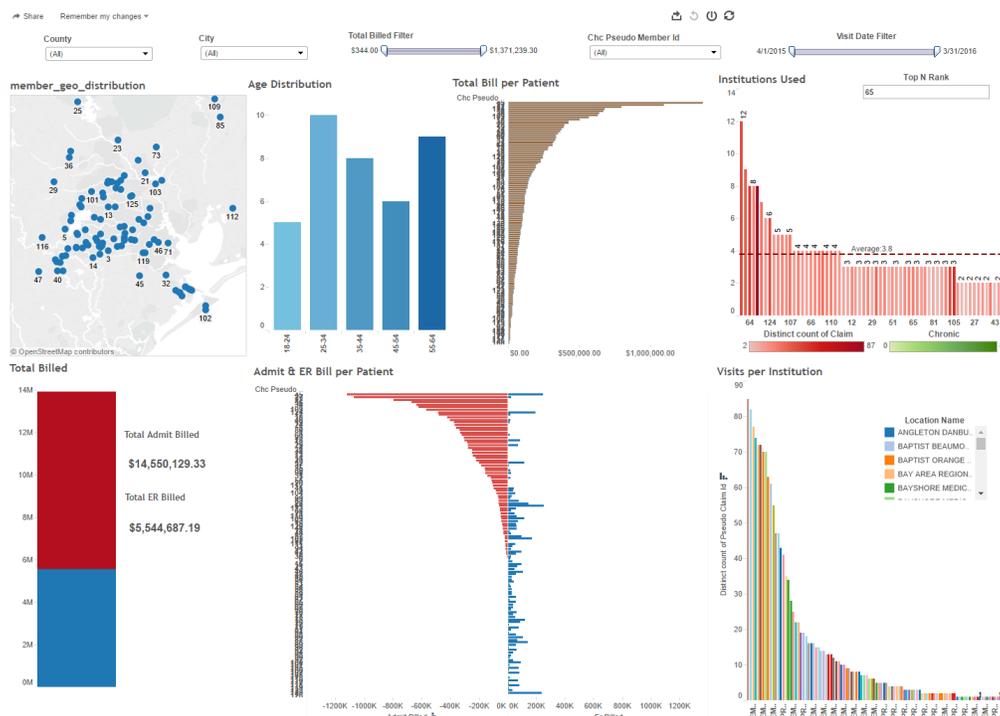
Most organizations are currently developing dashboards for their organization internally. While this is helpful at the organizational level, it only provides a part of the picture, with much information missing at the community level. This is where the Community Health Council's approach to data sharing and visualizations across system through overlap analysis provides a more complete solution, as discussed in the Introduction.

Looking at dashboards from a content perspective, there are three dashboard types that PCIC develops:

1. Client Selection Dashboards
2. Custom Stakeholder Dashboards
3. Overlap Analysis Dashboards

CLIENT SELECTION DASHBOARDS

Client Selection Dashboards are developed primarily for a specific organization or stakeholder to help identify super utilizers and intake them into an intervention program. These dashboards have a very specific purpose and are designed around the key goal of super utilizer identification with filters targeting that purpose. An example of a client selection dashboard is shown below. For more examples, please see Appendix D.



CUSTOM STAKEHOLDER DASHBOARDS

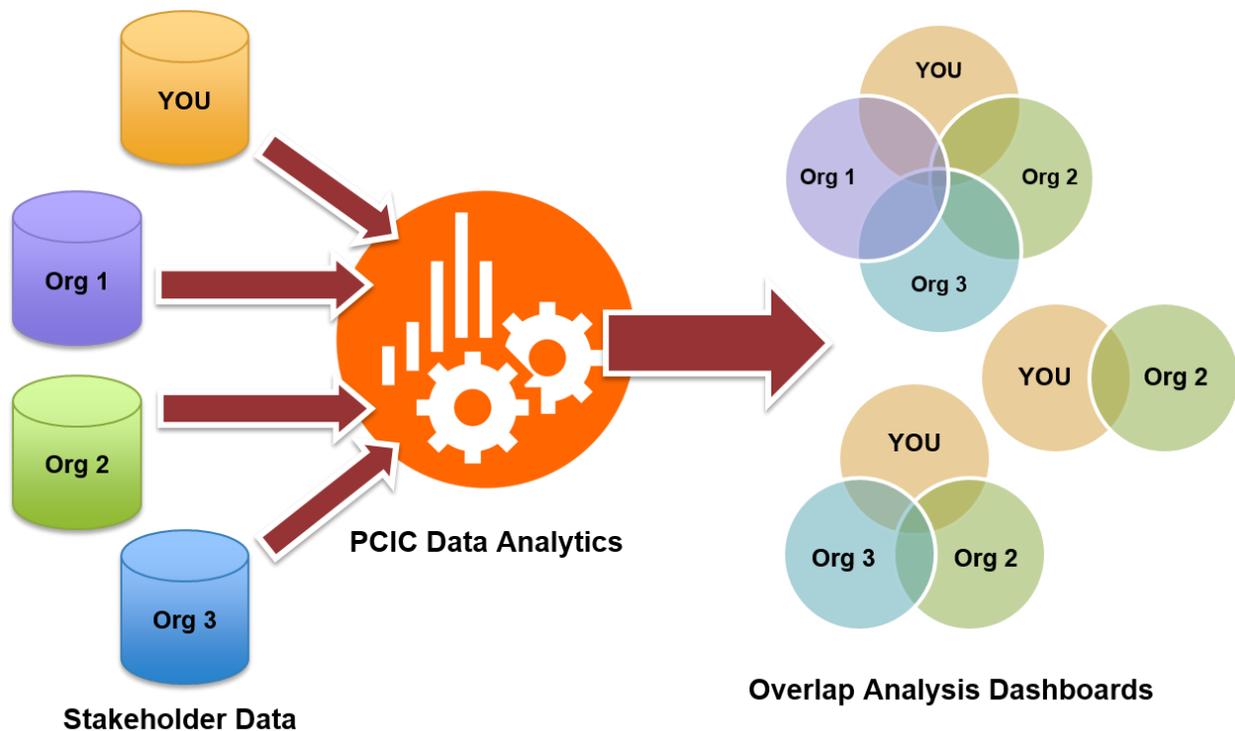
Custom Stakeholder Dashboards are developed on-demand by a specific stakeholder. The requirements and data sources are driven completely by the stakeholder and usually are built for a specific purpose. An example of a custom dashboard would be “Disease-specific readmission analysis at an organization”.

OVERLAP ANALYSIS DASHBOARDS

Overlap Analysis Dashboards are a range of more complex dashboards, where multiple datasets from different stakeholders are linked together to identify overlapping patient utilization across providers in the community. The linking between the datasets can be done in a variety of ways, for example:

1. Linking individuals across systems using globally unique identifiers like SSN or driver license numbers
2. Linking individuals across systems using fuzzy logic on fields like name, date of birth and gender (or other demographic data fields), when globally unique identifiers are not available
3. Linking records across systems using geocoded data, like an address
4. Linking records through a parent or guardian or some other relationship between individuals

A simple view of how Overlap Analysis Dashboards are created is shown below.



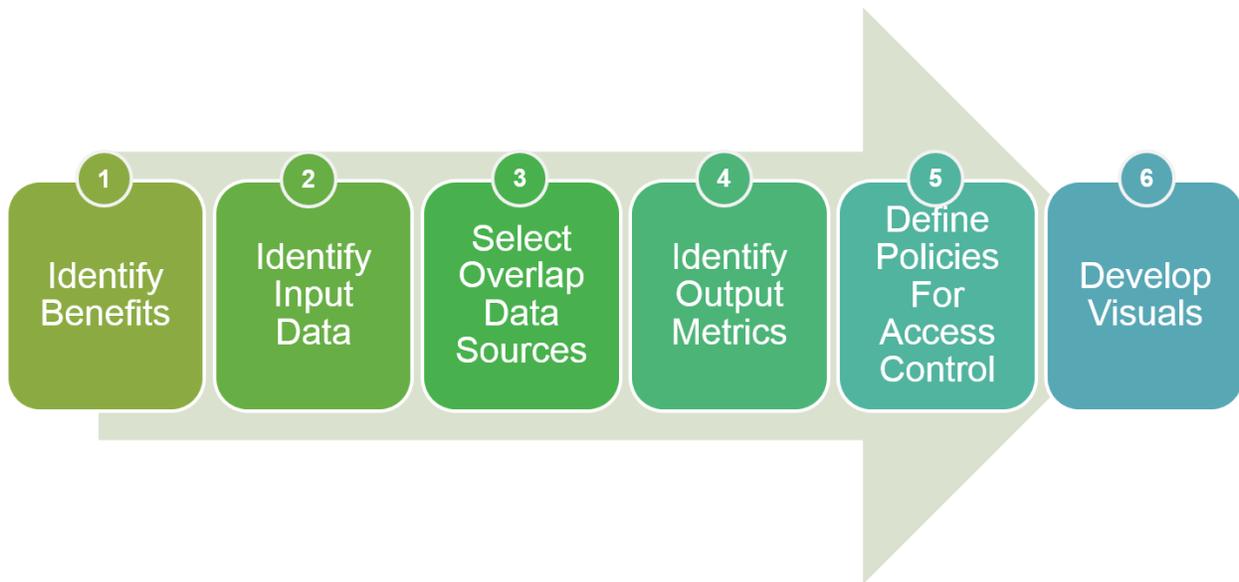
Overlap analysis delivers a complete picture of a patient’s “story” and utilization, when compared to “silo” based analysis which provides just a partial view into the patient’s history. It helps identify overlaps and redundancies in services provided to the patient by different providers and institutions, which may not otherwise be visible, if analyzed one institution at a time. Overlapped visuals also provide true aggregations across systems, and shows a chronological progression of service utilization – helping fill gaps in a patient’s history.

MASTER CLIENT INDEX

One of the key database pieces required to build an overlap analysis dashboard is the “Master Client Index” (MCI). The MCI is a repository of the clients in the health ecosystem, linked across multiple systems, as described in the previous section. The complexity of a MCI not only arises in its development, but also in the access control procedures that need to be in place to access it. Additional details of the MCI can be reviewed in Appendix A.

STEPS TOWARDS DEVELOPING USEFUL DASHBOARDS

PCIC has developed a simple and easy set of six steps to help a stakeholder or organization understand their role in the data sharing process, and the steps involved in building a truly useful dashboard, as a team. These steps are:



1. IDENTIFY BENEFITS

The first step in dashboard development is to identify what the benefits would be to you. What is it that you are hoping dashboards will help solve? A good place to start would be to think of the main problems you are facing as an organization. Is there data available that can help shine light onto these problems, to either better understand the cause of it, or help quantify the problem as well as the outcomes of the solution?

These benefits might include, but are not limited to, the following:

- Improve efficiencies (specify what these improvements might be)
- Build a safety net
- Identify duplication and redundancies in service
- Reduce cost

Use the workbook at the end of this document to identify the benefits to your organization.

2. IDENTIFY INPUT DATA

The next step in the data-sharing process is to identify the data fields that you can provide to PCIC. Example lists of data fields are provided in the workbook starting on page 8. Data input fields will fall into one of two categories: 1) client identifier and demographic data and 2) visit-specific data. Use the workbook at the end of this document to identify the input data that your organization can provide.

3. SELECT OVERLAP DATA SOURCES

Once you have identified the input data, you can select which organizations would be most helpful to perform an overlap analysis with. A reason that clearly identifies why an overlap with a specific organization's data will be beneficial to you and/or the other organization is required. Since organizations will fall into categories of "covered" or "uncovered" entities under HIPAA, a detailed review of the selection will need to be performed. More on this topic is discussed under Access Control Policies. Use the workbook at the end of this document to identify the data sources you would like to overlap your organizations data with.

4. IDENTIFY OUTPUT METRICS

Identifying output metrics is the mechanism for providing a clear structure on how you would like to measure the benefits you identify in step 1. What are the metrics you think work best for your organization? These metrics that you identify will drive the visuals that appear on your dashboard. Use the workbook at the end of this document to identify the output metrics that work best for your organization.

5. DEFINE POLICIES FOR ACCESS CONTROL

This design of the MCI is different from a lot of traditional MCIs or (MPIs – Master Patient Index) as the partnering organizations and stakeholders are both healthcare and non-healthcare organizations, or covered and non-covered entities. Data access policies to both these groups will vary based on regulations and contractual agreements, and in a number of cases will require de-identification of parts of the data and/or access to the data only in aggregation to protect confidentiality. In this step, we work together to create an overview template of access control policies that will need to be implemented on your data fields as well on any dashboards and views that are shared with you.

6. DEVELOP VISUALS & GRAPHICS

The development of visuals and graphs for your dashboards is an iterative and collaborative process, where we work together in an agile framework to build the best solution that works for you. PCIC starts off by developing the dashboard(s) based on your input in this workbook, followed by iterations where the dashboards are tweaked based on your input.

WHAT HAPPENS WHEN WE (PCIC) RECEIVE YOUR DATA?

The first step in the process is to transfer data via a secure data transfer mechanism. This can be done via secure mail or by using PCIC's secure data transfer portal.

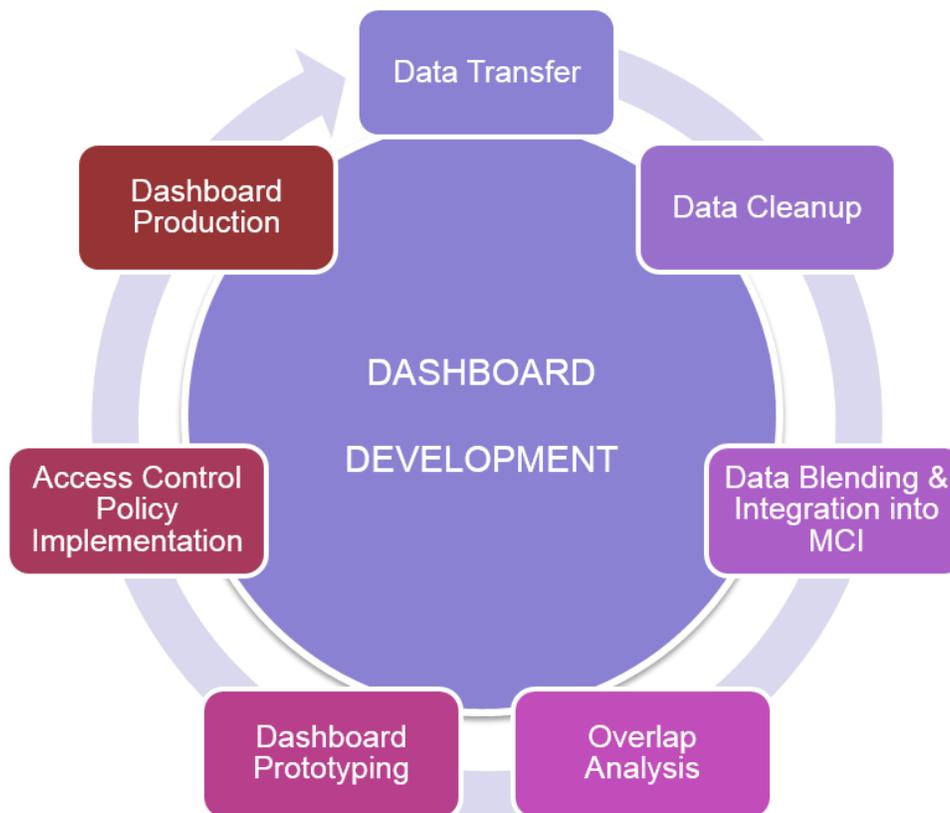
Once the data is received, we put it through a cleanup process where we eliminate and clean up bad data and migrate it into the PCIC data store.

Once the data is initialized into the PCIC data store, it goes through a data blending process, where records are linked in two ways: 1) linking to existing records from previous data dumps from you and 2) linking to records in other datasets through the MCI.

The next step involves performing overlap analysis on the data based on common goals and criteria identified by you and other stakeholders who have a shared view with your data.

Following this, prototype dashboards are built based on your specifications in the dashboard development workbooks. Access control policies and permissions are granted to the dashboard, and views accessed by the dashboards.

Once the iterative process of prototyping and development of the visuals is complete, the dashboard is moved into production. This continues on as a cyclic process, every time we receive new data. A visual of this flow is shown below.

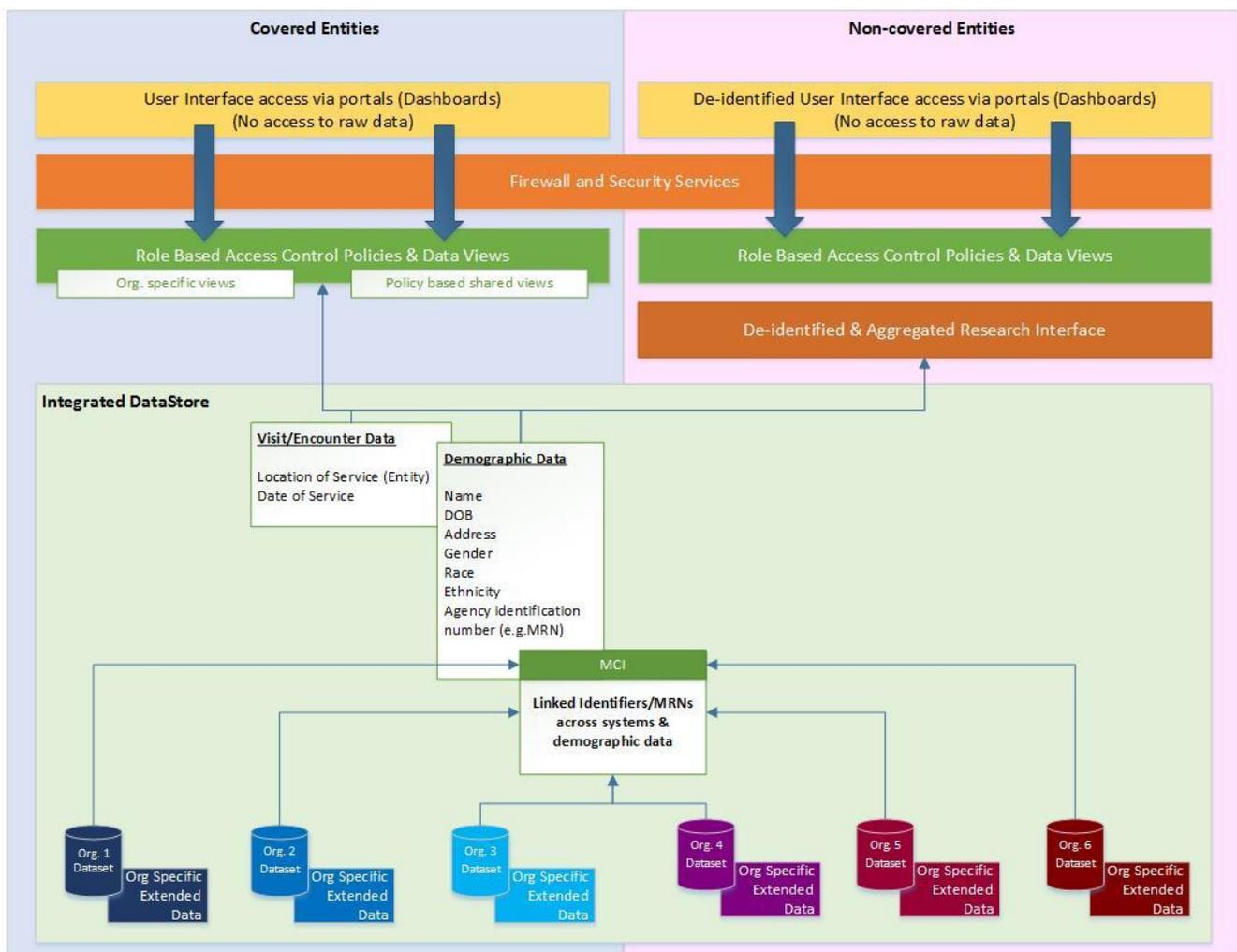


APPENDIX A: DETAILS OF THE MASTER CLIENT INDEX (MCI)

The MCI is a repository of the clients in the health ecosystem, linked across multiple systems. The linking of records in the MCI is done in a variety of ways, including:

1. Linking individuals across systems using globally unique identifiers like SSN or driver license numbers
2. Linking individuals across systems using fuzzy logic on fields like name, date of birth and gender (or other demographic data fields), when globally unique identifiers are not available
3. Linking records across systems using geocoded data, like an address
4. Linking records through a parent or guardian or some other relationship between individuals

The MCI also produces a unique identified of its own that can be used across system as an access identifier. A high level design of the MCI along with the data flow and access to it is shown in the diagram below.



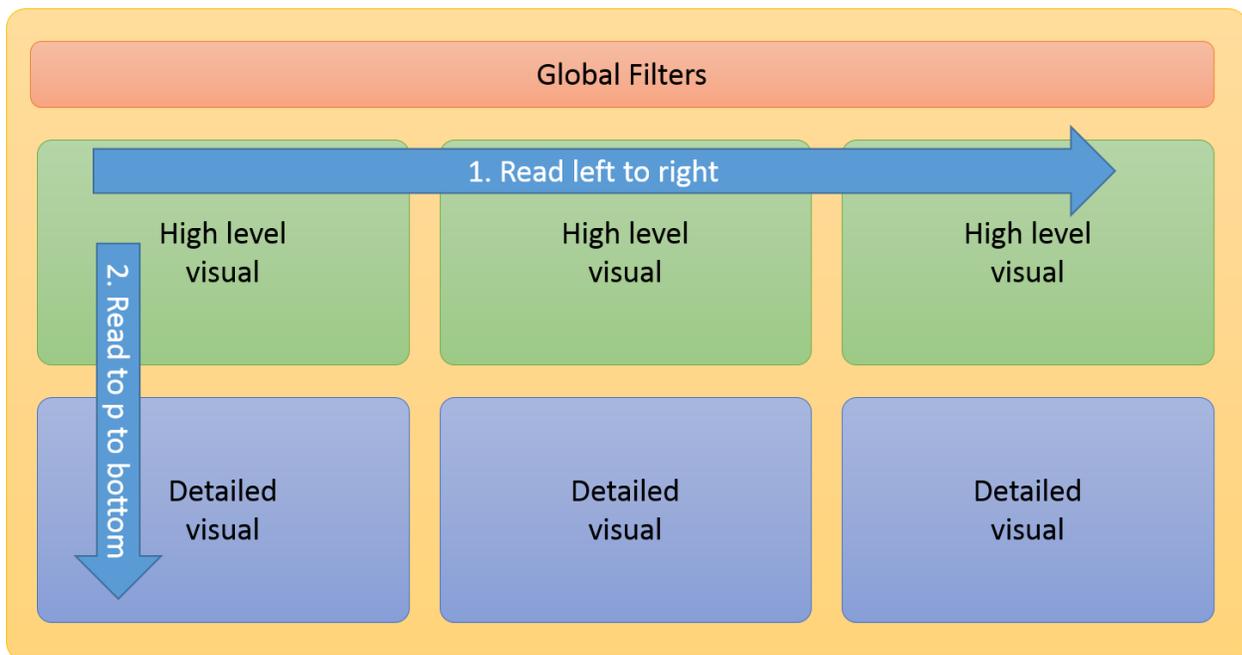
At the heart of the data sharing endeavor of the Community Health Council is an integrated DataStore or Data Warehouse that contains multiple datasets and databases linked using the MCI, hosted behind a secure firewall. This design of this MCI is different from a lot of traditional MCI or (MPIs – Master Patient Index) as the partnering organizations and stakeholders are both healthcare and non-healthcare organizations, or covered and non-covered

entities. Data access policies to both these group will vary based on regulations and contractual agreements, and in a number of cases will required de-identification of parts of the data and/or access to the data only in aggregation. All data views that are created in the system will adhere to clearly identified access control policies, that identity the level of access and visibility to individual data fields, to all users who have access to the system. The system is designed to prevent access to raw data, instead providing access only via secure dashboards and customized database “views”. Content of dashboards may be identified or de-identified, or aggregated data views only, based on the access control policy applied to the specific users account.

APPENDIX B: DASHBOARD DEVELOPMENT AT PCIC

Dashboards provide a platform to view multiple visuals or graphs using a collection of data, usually aggregated by “dimensions”, depicting one or more “measures”. To understand dimensions and measures, let’s look at an example of a bar graph that depicts the top 10 diagnoses seen at a particular facility. In this example, the diagnoses are dimensions and the count of patient visits with the specific diagnoses is the measure. Dashboards combine multiple visuals or graphs in a single interface, optionally linking together the visuals to provide an interactive experience to the end user. The goal of dashboards is not just to provide a static interface or view of the results and outcomes, but to enable the user to interact with the data, define and change their filter criteria and extract insights from it that would otherwise not be possible from a static interface (like a score card).

At PCIC, most dashboards are standardized as shown in the diagram below.



Global filter are provided at the top of the dashboard that allow to filter the data, for the visuals and graphs below it. Global filters usually provide the ability to select data based on a date range, or other high level attributes such as location, facility, costs, diagnoses and DRGs. The selections available in the global filter will vary depending on the type and purpose of the dashboard.

Data visuals and charts are present below the global filters and are read left to right and top to bottom. High level visuals are usually present further up on the page and more detailed view are present lower down on the page.

Most high level graphs are clickable and selectable. When a particular selection is made on a graph, it may cause other graphs to automatically filter out their views based on the selection.

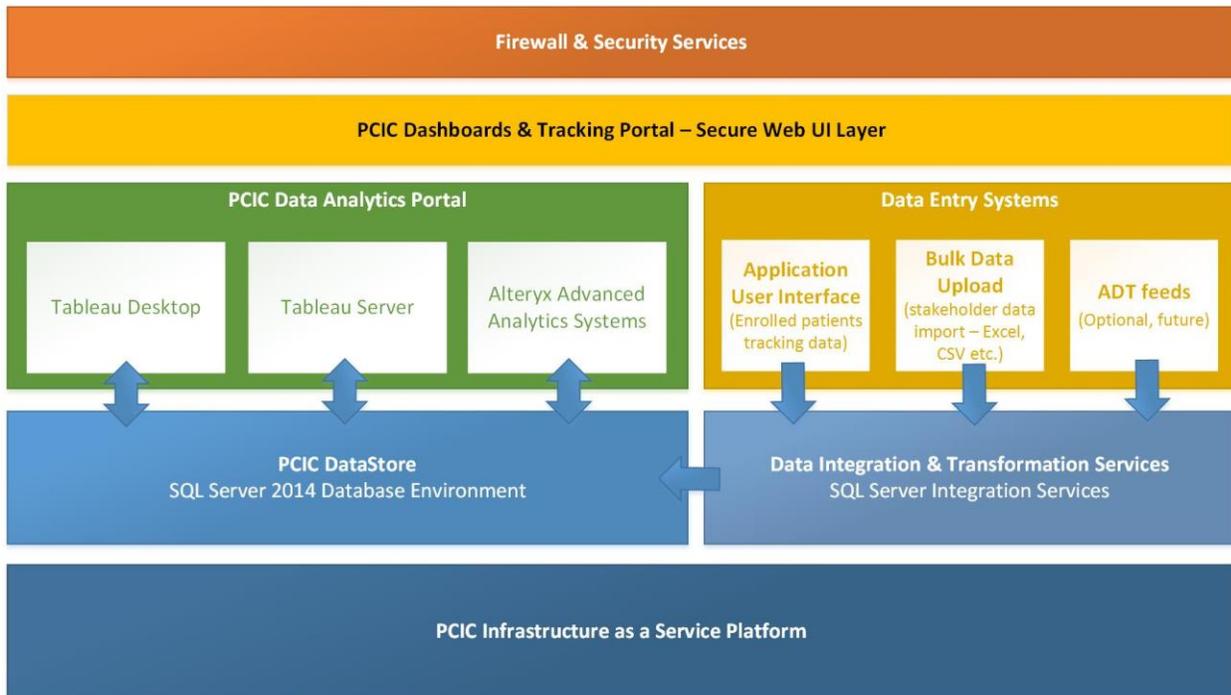
APPENDIX C: DATA SECURITY, INFRASTRUCTURE AND POLICIES

The software and hardware infrastructure that hosts the data and application environment is maintained by PCIC on data centers that meet HIPAA compliance and regulations. All communication between users and the environment takes place over an encrypted layer, providing the highest level of security at all times. In addition to this, PCIC data centers are audited in accordance with SSAE 16 (SOC 1 Type 2 and SOC 2 Type 2 and SOC 2 Type 3) standards.

The PCIC databases run on a SQL Server 2014 database system that is maintained on a mirrored environment for reliability and uptime. The environment is setup with automated encrypted backups, with support for automatic failover capability in the event that the primary server goes down.

The performance of the system is continuously monitored to identify and fix any issues or bottlenecks that may arise and cause performance degradation.

A high level view of the infrastructure is shown in the two figures shown below.



PCIC Portal – Production Environment Overview

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