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What Is Needed for True Population Health Intelligence?

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ABSTRACT

Health care has long been focused on providing reactive care for illness, injury, or chronic conditions. The rising cost of providing health care has forced many countries, health insurance payers, and health care providers to shift approaches. A new focus on patient value includes providing financial incentives that emphasize clinical outcomes instead of treatments. This focus also means that providers and wellness programs are required to take a segmentation approach to the population under their care, targeting specific people based on their individual risks.

This session discusses the benefits of a shift from thinking about health care data as a series of clinical or financial transactions, to one that is centered on patients and their respective clinical conditions. This approach allows for insights pertaining to care delivery processes and treatment patterns, including identification of potentially avoidable complications and variations in care. The result is greater insight into the factors leading to quality care and positive clinical outcomes.

INTRODUCTION

Health care systems are now largely digital. Continued adoption of electronic health records (EHRs) married with the explosion of data coming from wearable and implantable devices (for example, fitness trackers, medical monitors, implantable nanosensors) puts the industry in the heart of the “big data” revolution. External to health care systems, social media and mobile device data add another exponential factor to the amount of available data that can be combined with health survey data, economic data, or other demographic data. All combined, this ecosystem of data, when aggregated and analyzed effectively, provides a new level of population health intelligence for care teams (see Figure 1).

Figure 1. Big Data – Shaping the Landscape for Population Health

SAS addresses the issue of analyzing and visualizing big data in a number of ways across industries. SAS® Visual Analytics, SAS® Visual Statistics, in-database processing, and most recently, the SAS® Viya™ platform all provide the means to handle extremely large volumes of data and bring insight to the subject of interest. More recently, SAS released a health analytics framework that supports the transition of the industry to a value-based care environment where accountability for population health improvements falls across the spectrum of payers, providers, and government.

Population health analytics brings familiar data management challenges when dealing with nonstandard formats, measures, values, and terminology within health care. In today’s era, making sense of the raw data chaos is critical to enabling analytical insights. The SAS Health Care Common Data Model enables the standardized use of data from unlike sources so that there’s a common and logical base for analytics.

SAS® Episode Analytics and SAS® Real World Evidence provide an understanding of how two types of approaches bring deeper understanding to the clinical outcomes observed in the population.

With these technologies and others, SAS users in health care are having tremendous success applying SAS solutions to their challenges around population health initiatives. Medical technology is advancing at a rapid rate, but the industry is struggling to reduce costs and improve health. Every patient, consumer, and employee of a health care organization has a role in making health care safe and affordable. Analytics is one of the catalysts that can make a difference, but it has to be embraced! Let's explore some of the ways that analytics can be leveraged.

BIG DATA IN HEALTH CARE

Data sources in the health care ecosystem are vast and highly diverse. Standards organizations like HL7® International are providing data standards that bring some commonality to data and messaging, and newer interoperability standards (FHIR, see hl7.org/FHIR) that provide valuable connectivity across the health care landscape. The digitization of health care records and the proliferation of wirelessly connected wearable devices adds to the already complex landscape of claims systems, lab data, imaging, genomics, social media, and many more data sources. The data is BIG – even by today's standards where petabytes are now quantified regularly.

DATA MANAGEMENT CHALLENGES

Most organizations face similar issues around data management, data quality, and timeliness of data. The first challenge might simply be getting access to the data, whether it's because of data silos, protected health information (PHI) concerns, or the EHR is more like a locked bank vault when it comes to getting data out of it for analytics. Data accessibility and authorization are the primary reasons organizations are encouraged to have a data governance strategy in place.

For population health analytics, the broader challenge is knowing what questions will be asked of the data and making sure you have the data in a format that will provide the answers. For example, will value-based care (and payments) require the analysis of episodes of care? What types of cohorts do we want to explore in the population? Do we want to stratify our population based on health risks, costs, utilization, or other factors? Have we proven the value of socioeconomic information? For providers, do we have a partner with claims data that can provide a more complete picture of our patient's world?

To properly prepare our data to answer our questions, consider these requirements as well:

- Both real-time and historical information are important. Family history and medical history are relevant, but current medication use and vitals impact any real-time analysis, particularly in an acute setting.
- We need the ability to look at both event-driven scenarios, like an acute event in a hospital, as well as population studies where rates of disease prevalence within geographies are analyzed.
- Multiple systems always exist, so a strategy for data integration across those systems is often required to get a complete picture of the population. Legacy systems, facility-specific systems, cloud-based third-party data, public databases, registries, and more can all play a part in contributing to a better understanding of our population.
- Quality health care requires an investment, and correlations between clinical data and the cost to administer treatments reveals the impacts that costs can have on patient health. The analysis of the combined observational and claims data brings great insights that are not possible with either set of data on its own.

HEALTH ANALYTICS DATA MODEL

The story has been told many times of how analysts spend 70-80% of their time preparing data and only 20-30% of their time doing analysis. Having a model in place that standardizes data from the vast health care ecosystem is an investment that provides long-term payback. SAS has a robust and flexible health care common data model (HCCDM) for both claims data and electronic medical records. Figure 2 represents a sample of data sources mapped into the common data model that is optimized for analysis of health data. The data model adapts easily to socioeconomic data, registries, surveys, and more.

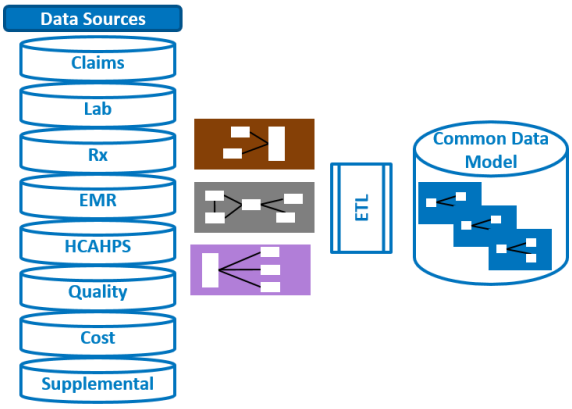

Figure 2. Data Mapped to Health Care Common Data Model

While patient centric, it allows multiple entry points for analyses of various types, such as cost, utilization, compliance, fraud, or research and discovery. Payers, providers, government, academics, and health information exchanges (HIEs) can all leverage the strengths of the model and get analysts back to spending 70-80% of their time doing analysis. The data model has a number of capabilities:

- Supports detailed information as well as analytical summaries
- Stores additional patient facts and social determinants
- Allows for a consistent patient identifier across EMR/EHR and claims data
- Handles structured and unstructured data
- Enables the storage and usage of all relevant code vocabularies
- Patient and provider data is separated to allow general access to demographic or group descriptors and secured access to identifiable information
- Is extensible
- Enables users to easily create longitudinal patient views
- Enables users to easily aggregate patient data
- Facilitates the creation of complex patient cohorts
- Manages timelines and data refreshes

SAS SOLUTIONS FOR POPULATION HEALTH

The health care industry has been using SAS for years to address population health needs, but two solutions have been developed that address specific challenges of today's health systems. SAS Episode Analytics takes all of a patient's health transactions and groups them into episodes of care. Both acute events and chronic diseases can be viewed as an episode of care and analyzed for patterns of high cost as well as high and low utilization such as gaps in recommended care. SAS Real World Evidence looks at both medical records and claims data, provides a robust view of the population and optimizes the creation of patient cohorts for population studies. Each solution enables a new analytic approach to population health analytics.

ANALYZING EPISODES OF CARE

From diagnosis to treatment to medication to aftercare, health care interventions entail encounters with many different providers in many different settings. As the industry shifts to value-based care, understanding an entire episode of care, such as a knee replacement, allows helpful comparisons of similar procedures across hospitals and providers. Figure 3 represents how episodes are created over the continuum of care for a knee replacement. For chronic diseases, there is tremendous opportunity to

better identify gaps in care, patient compliance, risks, and outcomes of interest when analyzing a patient's diseases as chronic episodes.

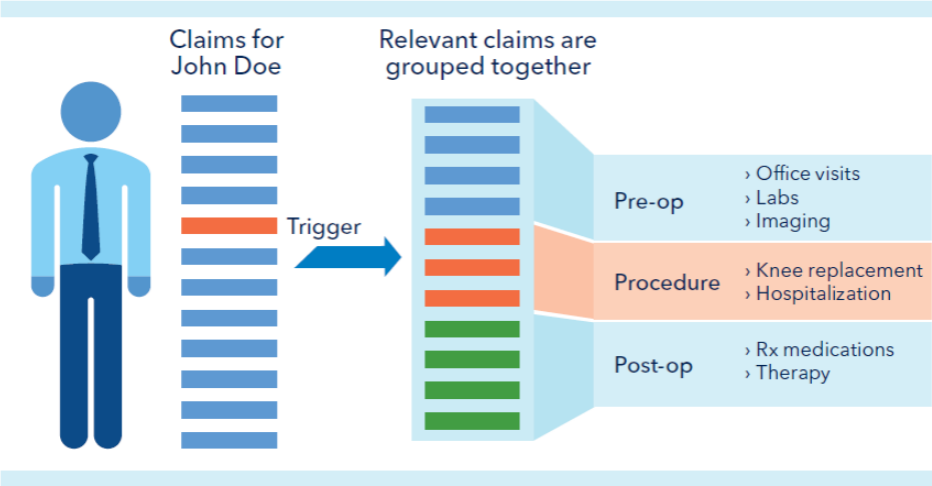

Figure 3. Knee Replacement Episode

Episodes of care can be determined several ways. SAS Episode Analytics supports the Center for Medicare and Medicaid Services (CMS) Bundled Payments for Care Improvement initiative (BPCI), where episodes of care are defined for both acute events like joint replacements as well as chronic conditions such as diabetes. Episode definitions developed by the Health Care Incentives Improvement Institute (HCI3, now part of Altarum Institute) and made publicly available are also included. These episodes (over 90 at the time of this writing) also address many standard types of care and cover services across all providers that would typically treat a patient for a single illness or condition[1]. An organization can also have their own set of episode definitions. Using the SAS Episode Definition Manager, new definitions can be created and existing definitions can be modified to meet episode definition criteria.

The episode of care processing has several functions:

- Calculate episodes of care costs and identify medical services details
- Evaluate quality of care and identify costs of complications using associated rules
- Associate episodes' costs to each other
- Attribute costs at the provider level
- Provide risk adjustment and budgeting of episode costs
- Produce analytical-ready data sets

While the episodes can be used for payment methods, the analytical-ready data sets produced are the lynchpin to new insights for population health. In particular, chronic condition episodes can be analyzed using risk and segmentation models to define at-risk populations, measure effectiveness of interventions, and better understand health outcomes.

Here are some examples of findings when analyzing chronic condition episodes[2]:

- Congestive heart failure episodes - gaps in recommended care have a significant impact on potentially preventable emergency room (ER) visits
- Diabetes episodes - risk drivers of likelihood of and frequency of potentially avoidable ER visits are mostly severity factors controlling for age, gender, and episode duration
- Asthma episodes – propensity to seek care is influenced by age and patient-level risk factors

Generally, SAS Episode Analytics provides a meaningful framework to evaluate differences in risk profiles of patient populations with chronic conditions. The analysis of those episodes reveals evidence to

optimize care and drive change that not only makes health care accountable, but improves the quality of care overall.

ANALYZING REAL WORLD DATA

A common use case for real world data is to inform and support population health management initiatives. SAS Real World Evidence enables you to create subsets of patients to target from large sources of data using an intuitive user interface that identifies your target population. Using those patient identifiers, analytic-ready data sets are developed to analyze for potential interventions. Some of the key capabilities are:

- Interactivity with the data at near real-time performance
- Complex query support using Boolean logic and temporal relationships without programming
- Logical workflow for building index event cohorts and population cohorts
- Displays a running count of patients displayed that qualify for the cohort as criteria are entered
- Ability to save and manage cohort definitions and apply them to different data sources

In one example, a payer might be looking to identify patients who would benefit from a care management program. In the simple example, a care manager is using SAS Visual Analytics (which is licensed along with Real World Evidence) to examine a group of patients.[3] The care manager identifies patients with high costs to see how long it has been since each of those patients has been seen by a primary care physician. The approach is to look at patients who are consuming a lot of health care resources. They have their care monitored and managed on a regular basis by a primary care provider who can help ensure they have an appropriate care plan that will be followed to better manage their health in the long-term. In Figure 4, the data is filtered to include only those members who have not seen a primary care physician (PCP) in the last 180 days or more.

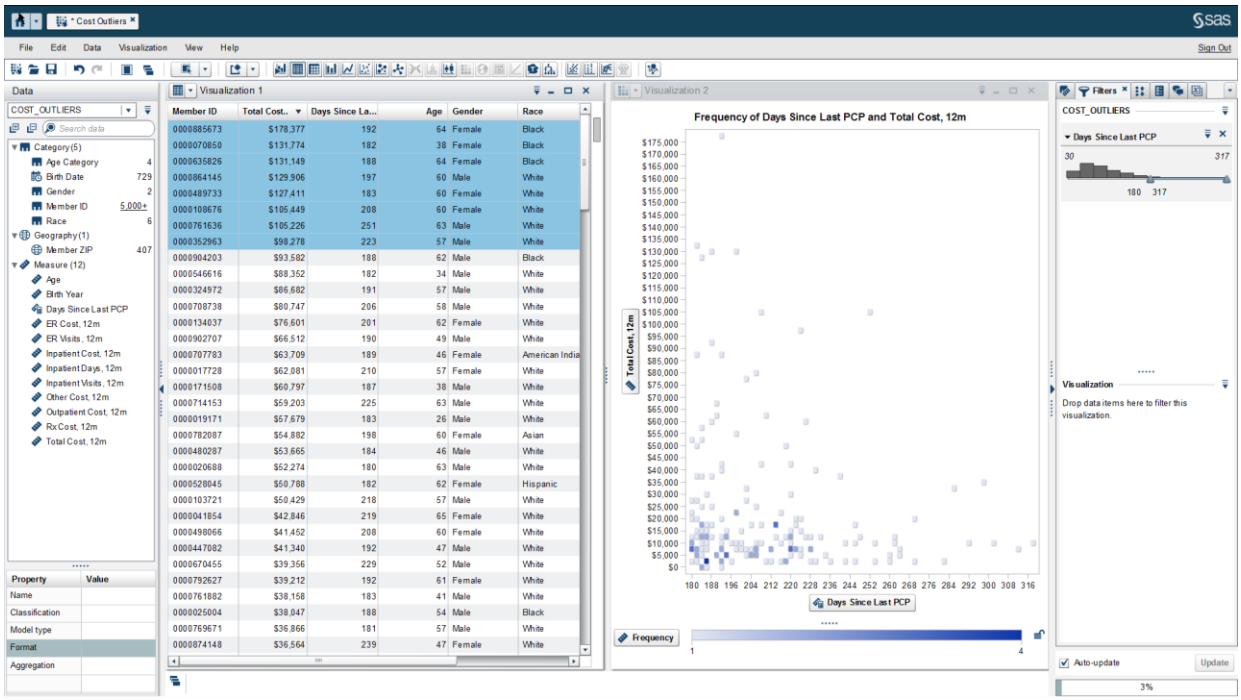

Figure 4. Members with High Costs and Low PCP Utilization

Processes such as machine learning or traditional statistical modeling techniques can be used to identify patients who are at the greatest risk for subsequent events. The methods also identify their likelihood to

respond to various types of interventions such as phone calls from nurses, support groups, emails, text messages, or other mechanisms of outreach. Using SAS Visual Analytics, a user can explore data in an ad hoc fashion to discover unexpected trends and issues, while reporting capabilities enable the creation of standardized displays. Reports are reviewed on an ongoing basis to monitor the status and activity of the entire population or just selected segments, for example, newly discharged patients or those in high-risk groups.

POPULATION HEALTH ANALYTICS AT WORK

There are numerous stories about the impact of SAS being used for population health analytics, and a number of them are documented at www.sas.com[4]. Two are described here for their accomplishments in overcoming data challenges and applying analytics to positively impact the well-being of their population and reduce costs concurrently.

DIGNITY HEALTH

Dignity Health, one of the largest health systems in the US, is partnering with SAS for a cloud-based, big data platform powered by a library of clinical, social, and behavioral analytics. Over time, the platform will connect and share data across the system's 39 hospitals and more than 9,000 affiliated providers. The goal is to help doctors, nurses, and other providers better understand patients and customize their care for better outcomes and lower costs.

Here are just a few of the opportunities they see for using big data for population health analytics[5]:

- Simplify data integration across the extended enterprise
- Manage the financial risks and incentives of emerging reimbursement models
- Proactively improve care quality and outcomes
- Drive greater efficiency of care delivery
- Engage patients as unique individuals

One of their projects is to identify patients with elevated risk of sepsis and identify who on staff is responsible for early intervention. They enable the tracking of which physicians and nurses are responding to sepsis alerts in a timely fashion. Key performance indicators are identified and validated statistically. Sepsis alerts are routed to the right person at the right time. In addition to building the alerts into the care provider's workflow, there are performance dashboards that analyze sepsis alerts by mortality rate, provider response, length of stay, and facilities. A 2016 article[6] in Patient Safety and Quality Healthcare describes the project and the impressive results:

- Average mortality rate for sepsis patients decreased by 7.25%
- Average severe sepsis rate decreased by 14.9%
- Physician response time with sepsis bundle orders was reduced by nearly 51%

Dignity' Health's sepsis bio surveillance program is already improving lives and saving costs, and they continue to seek ways to improve results as they work on additional population health initiatives.

GENEIA

Geneia is a population health management company that provides technology to integrate disparate data sources, like EHR data, claims data, psycho-social data, activity tracker data, and device data. They create a comprehensive view of the patient both inside and outside the clinical setting. With this aggregated big data, they can support risk stratification of the patient population, allocate resources to close care gaps, and support changes in patients' behavior outside the clinical setting.

Theon® is a SAS based Geneia solution that adapts the Institute of Health Improvement's (www.ihi.org) Triple Aim measures. Theon gives them a way to work within the different components of the Triple Aim framework that addresses population health, individual health, and health care cost. The platform brings

together all available data sources and uses advanced analytical models. The system helps identify and care for targeted patients and populations within ACOs.

Working with Geneia, one ACO client found[7]:

- A targeted list of discharged patients who would benefit from home monitoring to avoid future ER visits and potential readmission
- One patient currently in the hospital who had 13 prior admissions as well as more than 200 specialty visits and 150 prescriptions
- Ten patients with more than $100,000 in medical costs who had not been seen by their primary care physician in more than 12 months
- Two physician practices with significantly higher prescription costs than their peers and information to remedy the situation

Geneia is also using SAS to analyze data coming from sensors in wearable devices. They collect streams of data and use machine learning to improve the predictions over time. Geneia care teams track changes in a patient's condition and identify opportunities for earlier interventions. Using the device data, they have the chance to prevent further decline in the patient's health.

CONCLUSION

Gaining true population health intelligence comes with many challenges, and they all typically start with big data. A health care common data model powers a platform that can serve as the foundation for population health analytics. Solutions like SAS Episode Analytics and SAS Real World Evidence provide frameworks for getting to results quicker – even when identifying risk factors, high costs, or selecting the right patient population for interventions from millions of members or patients.

Dignity Health, Geneia, and other health care organizations are embracing big data. They develop predictive models, tune them behind the scenes and surface them through dashboards or plug them into care providers' every day workflows. The exploitation of relevant data and analytics is vital to population health intelligence. Healthcare leaders who are embracing innovative deployment of health analytical insights are paving the way to industry transformation.

REFERENCES

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ACKNOWLEDGMENTS

Thank you to my industry and SAS colleagues who provided perspectives on both challenges and successes in implementing solutions that address population health concerns. We all benefit when industry colleagues are willing to share their stories of SAS projects that have significant impacts on the well-being and safety of the population.

RECOMMENDED VIEWING

- Webinar, “Better Care with Big Data Analytics, How Dignity Health lowers costs, increases revenue and improves clinical outcomes.” Available at: https://www.sas.com/en_us/webinars/better-care-with-big-data-analytics.html

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