Developing a population health management program
Considerations for population segmentation

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INTRODUCTION

Population health, or population health management (PHM), has become synonymous with the future of healthcare. In 2015 Congress passed the Medicare Access and CHIP Reauthorization Act of 2015 (MACRA).[1] This legislation created regulated financial incentives for healthcare providers to embrace the goals of PHM. In a perspective piece published in the New England Journal of Medicine, the Secretary of Health and Human Services (HHS), Silvia Burwell, elaborates, "We have put in place policies to encourage greater integration within practice sites, greater coordination among providers, and greater attention to population health."[2]

There has been great public pressure in the United States to improve the quality of our healthcare system, with a key focus on developing the competencies required to advance toward the "Triple Aim" goals (improved health of populations, reduced per capita costs, and improved patient experience). Population health management is at the heart of improving health, and touches all three components of the "Triple Aim."

The utilization of predictive analytics to effectively identify patients who can benefit from medical interventions in an effort to improve outcomes is a growing movement. One common method for identifying these patients is through population segmentation, a process in which individuals are grouped into cohorts that share common characteristics and require similar interventions to help improve the quality of their care. In this paper, we explore four common methods for population segmentation:

1. Cost cohort segmentation
2. Condition cohort segmentation
3. Utilization cohort segmentation
4. Social cohort segmentation

We will identify the benefits and drawbacks of each method of segmentation, and also provide examples of how each can be employed in a clinical setting.

COST COHORT SEGMENTATION

Through cost cohort segmentation, patients are identified for interventions based on the costs incurred during their treatment. Typical interventions include traditional care management and disease management programs, in which high-cost patients are identified and assigned care management specialists to organize often complex care.

These programs are commonly employed because they provide the most "bang for the buck." Effective management and treatment for a small number of high-cost members can provide a high return on a relatively low investment. Furthermore, because a high portion of costs are incurred by a small portion of the population, focusing on these members can have an effect on a significant portion of a plan sponsor's or hospital system's costs.

Programs can be either reactive or proactive in nature. In a reactive program, patients are chosen for intervention based on costs that have already at least partially occurred. Because of this, some "savings" may not be savings at all, but rather members returning to more normal, lower costs after a high-cost event. Without a sound predictive component, programs such as these will often overlook members who are not high-cost this year, but who might become high-cost next year. In contrast, a proactive program uses predictive analytics to forecast those members who may be expensive in the future. Prospective risk adjustment programs such as the Milliman Advanced Risk Adjusters™ (MARA™)[3] software can be used to predict expected illness incidence based on current data.

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[1] More information can be found here: https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/Value-Based-Programs/MACRA-MIPS-and-APMs/MACRA-MIPS-and-APMs.html.

[2] Burwell, S. M. (2015). Setting value-based payment goals — HHS efforts to improve U.S. health care. N Engl J Med, 372(10), 897-899. doi:10.1056/nejmp1500445.

[3] More information can be found here: http://us.milliman.com/mara/.

One challenge presented by cost cohort segmentation is the development of efficient and effective interventions. Grouping members by projected costs will likely produce segments of individuals with significant variations in care needs. For example, a segmentation method may be implemented to address those in the top 10% of healthcare costs in the previous year. While these members are all high-cost, that group includes patients with widely varying illnesses requiring different interventions. Even among those with diabetes, comorbid illness may dictate the appropriate interventions. Addressing patients with differing needs requires truly individualized medical care. While personalized care designed on a case-by-case basis offers many benefits, it is also challenging to design standardized and efficient care.

Implementing predictive algorithms to identify those patients who can provide the best improvement in tomorrow's outcomes is a difficult hurdle to overcome in these programs. Assessing the effectiveness of the chosen interventions is another major challenge to these types of programs. Assessments must attempt to separate normal claim fluctuations from cost-saving intervention effects.

CONDITION COHORT SEGMENTATION

Condition cohort segmentation views a population in an entirely different light from cost segmentation. By focusing on member conditions, segmented cohorts will inherently have more homogenous healthcare needs and hence will require similar resources. The personalization of care becomes more efficient when groups of individuals with common needs are assessed in conjunction with one another. As an illustrative example, consider a team of physicians assessing the needs of 100 patients denoted only as "high-risk patients" versus 100 patients with diabetes. Standardized protocols and needs assessments for the group of patients with diabetes can be more efficiently developed, allowing physicians to focus their efforts on gaps in care and outliers in current condition status.

Two key challenges in developing condition cohort segmentation programs include determining the specificity of cohorts to pursue and managing the increased demand for clinical support in the analytic process. In these decisions, there is a constant trade-off between efficiency gained by increasing the specificity of the chosen intervention group, and the loss of breadth in chosen patients as a result of that specificity. Identification of patients with diabetes allows a care team to assess the needs of individuals in this (less-homogenous) group. On the other hand, identification of 40- to 55-year-old patients with Type 1 diabetes with rheumatic

complications allows care to be more precisely assessed, while reducing the number of patients chosen for intervention. Increased specificity of cohorts increases care efficiency and precision, but reduces the number of individuals impacted. Appropriately balancing specificity and scope for a condition-focused population health management program requires significant efforts from an interdisciplinary care team.

The creation of useful condition cohorts also requires significant time investment from clinical experts. Many of the most impactful population health programs address comorbidities and integration of care. One example of this is in the growing trend of integrated medical-behavioral healthcare. A 2014 research paper published by Milliman for the American Psychiatric Association identified elevated costs for patients who had both a chronic medical illness and a serious and persistent mental illness, such as depression.[4]

Optimal condition cohort segmentation uses a proactive approach. Predictive tools can be used to identify the future incidence or severity of illnesses. Analytics are currently used effectively to project future condition states using inputs such as biometric readings, health risk assessment data, family history information, demographics, and past claim experience. The complexity of analytic efforts to produce these predictions can grow to onerous levels quickly. This complexity starts with the identification of what to predict. When predicting future claim costs, the same metric is predicted for every condition. This is not the case for the prediction of future incidence or severity of a given condition. A worsening risk for a patient with heart disease looks different from a worsening risk for a patient with rheumatoid arthritis. Because of this, the requirement to produce more and more disparate models, each requiring significant clinical expertise, can quickly generate unrealistic resource requirements.

Condition cohorts allow organizations to concentrate efforts on conditions where they can have the greatest impact (unlike with cost segmentation, where plan sponsors and providers may concentrate only on cost, and achieve diminished returns for those conditions where the delivery system does not excel). With condition segmentation, a plan sponsor or system can not only identify patients who can benefit from intervention, but also conditions for which the provider can achieve the best outcomes. As with the use of cost cohorts, condition segmentation can be reactive in practice (although this is suboptimal). Plan sponsors and carriers may use developing claim experience in order to identify

[4] Melek, S., Norris, D., & Paulus, J. (April 2014). Economic Impact of Integrated Medical-Behavioral Healthcare: Implications for Psychiatry. Milliman American Psychiatric Association Report. Retrieved April 18, 2016, from

https://www.psychiatry.org/File%20Library/Psychiatrists/Practice/Professional-Topics/Integrated-Care/Milliman-Report-Economic-Impact-Integrated-Implications-Psychiatry.pdf.

patients. In addition, by only concentrating on certain illnesses, plan sponsors and providers may miss opportunities elsewhere. This drawback can be mitigated through careful delegation of the right types of care for each patient.

UTILIZATION COHORT SEGMENTATION
Utilization segmentation takes cost and condition segmentation one step further by further identifying those patients who may use care ineffectively. In these programs, utilization patterns among patients are studied, and certain variables are chosen for intervention. For example, overuse of emergency room treatment can not only produce higher costs and worse outcomes compared with care done in other places of service, it can also be prevented in the first place in many instances. MARA can be used to identify patients who are more likely to seek emergency room care, so plan sponsors and providers can identify and intervene through proactive education efforts.

One example of this type of program lies in a study titled "Factors predicting development of opioid use disorders among individuals who receive an initial opioid prescription: Mathematical modeling using a database of commercially-insured individuals."[5] In this study, researchers used a variety of data variables with a goal of predicting which members are more prone to opioid misuse following an initial prescription for medical use. Researchers analyzed a mix of demographic, diagnostic, and healthcare utilization variables. Many of the same principles and techniques can be applied to other conditions (for example, postoperative infection and sepsis), where the goals include early identification and stratification of risk to achieve better public health outcomes.

These programs can be effective because only a portion of effective outcomes are tied to the intervention itself. A significant component of effective outcomes is related to decisions made by the patient, particularly when to utilize care, and what type of care to utilize. These programs are also more proactive in practice, by detecting potential utilization patterns before they occur and therefore intervening early.

These programs may achieve smaller savings on a case-by-case basis compared with case management and condition segmentation programs, because they don't always concentrate on the most expensive patients and illnesses.

Despite that drawback, these programs can be effectively employed in advanced population health management programs alongside cost and condition segmentation. These programs can provide greatly improved outcomes on a large scale, and can significantly improve the patient experience if patients can more commonly receive the right care in the right place. Successful implementation requires robust data, a deep understanding of the way the current system is used by patients, and analysis of often subtle patterns to identify the proper candidates for interventions.

SOCIAL COHORT SEGMENTATION
Plan sponsors and provider systems can go beyond clinical and insurance data to identify potential candidates for intervention based on social qualities of the patient. These qualities include location of residence, socioeconomic status, or other variables that may impact how a patient utilizes care. A 2014 Health Policy Brief published by Health Affairs and the Robert Wood Johnson Foundation summarized determinants of health outcomes from several major studies, showing that social determinants and environment constitute anywhere from 20% to 50% of a patient's health outcomes, depending on the study.[6] A patient's surroundings can have a major influence on health outcomes, and identifying those who can benefit most from improved care based on these variables can provide great benefits to population health outcomes.

These programs often work to identify those who do not achieve the proper diagnoses and care based on their socioeconomic or demographic status. A common example is to identify patients who cannot attend scheduled doctor's appointments because of poor access to transportation. By providing transport, these patients can access care earlier and improve the chance that interventions can be effective. Another less common example is underdiagnosed incidence of mental illness among working professionals. This is often due to demanding jobs and the current stigma of mental illnesses for professionals who may be too busy or embarrassed to seek proper care. By eliminating these barriers through methods such as telemedicine, professionals can access care discreetly and within their busy schedules.

Plan sponsors and hospital systems can also use other nonmedical data to identify patients who might benefit the most from intervention. Through analysis of commercially available consumer data, organizations can study large target populations to identify those who may be more at risk for illnesses, based, for example, on their purchasing habits. These programs can add effectiveness to population health management programs by expanding the potential candidates for intervention to those who have not yet sought any treatment. This aspect is

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[5]   Cochran, B. N., et al. (2014). Factors predicting development of opioid use disorders among individuals who receive an initial opioid prescription: Mathematical modeling using a database of commercially-insured

individuals. *Drug and Alcohol Dependence*, 138, 202-208. doi:10.1016/j.drugalcdep.2014.02.701.
[6] Health Affairs (August 21, 2014). The Relative Contribution of Multiple Determinants to Health Outcomes, Health Policy Brief.

unique to this type of program, because most other programs require some data collected through earlier medical interventions. In this way, they are quite proactive in practice.

These programs often address the needs of the most underserved of populations, including those with lower incomes. They can be used to enhance social medicine programs by better identifying the need for these efforts. These efforts can therefore be used to improve patient experience for these underserved populations.

As with utilization segmentation, these efforts may produce lower savings on a case-by-case basis compared with cost and condition segmentation. However, these efforts can greatly improve outcomes for patients by better identifying illnesses in those who may not have previously had access to care, beginning the process to improve that patient's health.

Of the four segmentations discussed in this paper, these programs can be the most difficult to implement. They often require analysis of data beyond traditional clinical and claim data, identifying patterns in data from other sources. Those patterns are usually quite subtle and require advanced techniques to recognize. These programs have given greater importance to predictive analytics in the healthcare industry.

CONCLUSION

Population health management is growing in popularity as a method to improve patient outcomes and curtail the growing cost of care. Applied correctly, these programs help to identify patients most in need through a careful marriage of practicing clinicians and healthcare data, freeing up providers to craft the most effective interventions for improving the healthcare system.

At the heart of these efforts are population segmentation methods, which aim to identify those populations who can best benefit from interventions. Although some methods such as cost segmentations are already common, others such as utilization and social segmentation have only started to become more popular as technological advancements and political pressures have led the industry toward new, expanded programs.

Each segmentation method discussed in this paper has its unique set of benefits and drawbacks. A successful population health management program begins with a careful analysis of the desired outcomes of the program. After those goals are identified, planning to identify the correct patients and interventions is crucial. Successful programs are deliberate in not only their planning and identification processes, but in implementing the correct interventions and analyzing results in comparison with those goals. Each of these steps is no easy task.

A population health management program that achieves success with one group can often be applied to another, but to achieve its full potential, each program will be individualized for its specific goals. In fact, the segmentation methods described in this paper are neither exhaustive nor mutually exclusive. A robust program may use multiple segmentation methods to achieve improved outcomes, combining them in interesting and creative ways. As lessons are learned, these programs become more effective, making a greater impact on how healthcare is delivered. While the population health management movement is flourishing in many ways, it is still just beginning to scratch the surface of its potential benefit to the healthcare system.

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