PATIENT RISK STRATIFICATION

Predict, Prioritize and Prevent Risk

A Scalable Health White Paper

SCALABLE HEALTH

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EXECUTIVE SUMMARY

The healthcare industry is undergoing a significant paradigm shift from a fee-based model to a Value-Based Care (VBC) model to encourage innovation, quality, and efficiency. In addition, hospitals and other healthcare environments are producing volumes of data beyond the current processing capabilities of existing legacy systems. Locked in this data are correlations to improve care outcomes and better manage scarce resources.

Artificial Intelligence (AI) and machine learning can support the changing healthcare landscape by offering insights that will improve care outcomes, reduce inefficiencies and drive down costs to meet the demands of value-based care contracts. These insights allow doctors to quickly assess patient populations, meet their care needs and align resources through risk stratification.

It is widely accepted that it best for patients to avoid emergency admissions to hospitals and to care for these patients at home when possible. To help identify those patients at high risk of emergency admission, Risk Stratification Models have been developed. General Practitioners (GPs) and their staff can use these tools to identify high-risk patients and provide extra care to keep them safely at home.

Risk stratification tools are predictive models that determine the likelihood of future events at clinical and administrative levels in the healthcare domain. They are also used to stratify a population according to a selected metric, such as the probability of readmission. In general, predictive models are algorithms (e.g. statistical models, machine learning algorithms, etc.) which provide information about the relationship between a set of parameters, such as age, gender, clinical information, diagnosis, living conditions, district of residence, and the predicted outcome (e.g. readmission to hospital, death, healthcare expenditure, length of stay in hospital, etc.).

When a patient presents, doctors need to assess the risk factors related to her condition. Unfortunately, patients can experience a wide degree of variability from provider to provider, and sometimes even within a given department of the same hospital. Risk Stratification models attempt to statistically predict the likely outcome of a course of treatment given the presence of certain risk factors or determinants. These assessments assist providers in identifying proven treatment options considering the identified risks.

Data Analytics and AI are essential for improving patient risk stratification models by integrating clinically relevant data into health IT platforms offering actionable information to providers to better manage population health concerns and care coordination. These tools ensure providers are operating with real-time data offering the latest intervention strategies and treatment protocols given the patient´s risk factors. The resulting insights will be used to guide safe, appropriate and effective care to the patient.

The future of risk stratification needs to integrate data from whatever sources are available (EHRs, IoT devices, population health data sets) in real-time to accurately access an individual patient's risk factor and to assist the provider in determining the most appropriate proven treatment protocol for the best care outcome. Further, risk stratification tools will help healthcare organizations access their patient populations to understand their risks to assist providers in managing their resources to meet the needs of all their patients.

INTRODUCTION

Risk stratification is "the process of assigning a health risk status to a patient and using the patient's risk status to direct and improve care," according to the American Academy of Family Physicians (AAFP). "The goal of risk stratification is to help patients achieve the best health and quality of life possible by preventing chronic disease, stabilizing current chronic conditions, and preventing acceleration to higher-risk categories and higher associated costs."

Risk Stratification accesses patient populations for the likelihood that an individual will experience a particular outcome. A risk score may indicate the likelihood of a single event, such as a hospital readmission within the next six months, while a risk stratification considers multiple risk factors to create a complete patient profile better meet his ongoing healthcare needs.

To support value-based care, providers need to stratify patients by risk in order to identify and address high-priority issues that impact larger groups of patients. This permits healthcare organizations to intervene or mitigate these risk factors to forestall or avoid costly events, and ensure that the individual needs are met in a timely and efficient manner.

Consider two patients who have recently visited a hospital's emergency room – the first patient was a child who suffered a sprained wrist from falling on the playground. Other than the sprained wrist, the child presented no other symptoms and was treated and released. Suffice to say, this patient was at low risk for readmission. The second patient was a male in his sixties complaining of chest pains. This patient had a history of heart diabetes, type 2 diabetes and was overweight. The patient's comorbid conditions significantly increase the risk for readmission. As such, this patient requires more follow up care to ensure he is taking his medications, following dietary restrictions and seeing his primary care provider to reduce the risk of another acute event.

When a patient checks into a hospital there is a primary piece of information available about his admission. For example, he has been admitted because he scheduled for coronary bypass surgery on Thursday at 10 am. But beyond that, there is so much more than we know about this patient. His sex, his age, his medical history, current disease progression and any other conditions and medications – these additional insights are risk factors. And to varying degrees, they may impact the overall outcome of his procedures. The potential, or risk, of a negative impact (based on similar patients with these risk factors) on this patient's individual risk factors, will need to be proactively addressed to ensure the patient has the best course of treatment given his current health profile. Certain characteristics predispose patients to higher risks, therefore requiring providers to consider alternative treatment options to mitigate these concerns. The presence of multiple risk factors, for example, hypertension and diabetes, further complicate the risk assessment.

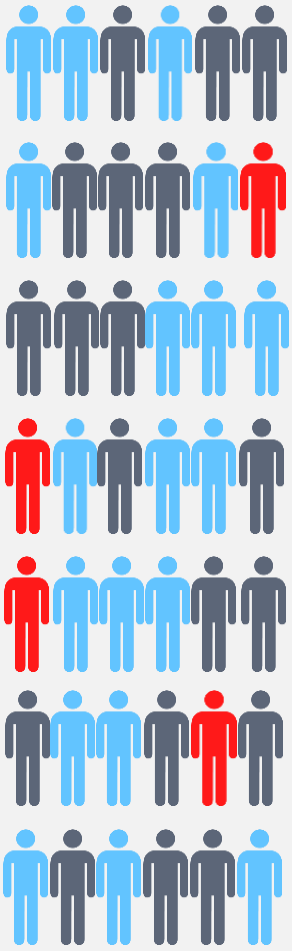
Beyond understanding an individual's risk, healthcare organizations need to understand population risk to help manage their resources and personnel. Sorting patients into risk tiers (high risk, rising risk, and low risk) increases a healthcare provider's understanding of their patient population allowing them to design interventions to proactively address the needs of at-risk patients. Risk stratification models heavily weigh comorbidity factors, as studies have shown their presence significantly increases the risk of readmission along with the patient's ongoing cost of care.

Risk stratification models are used for population health management. Based on the risk assessment, healthcare organizations can design intervention protocols and treatment options to best meet the needs of the patient based on proven predictive data.

RISK STRATIFICATION

To succeed in the new world of value-based healthcare, health systems must keep the healthy as well as possible through preventive care, and prevent the chronically ill from getting sicker. So, take the time to separate the patient populations you're targeting into risk groups.

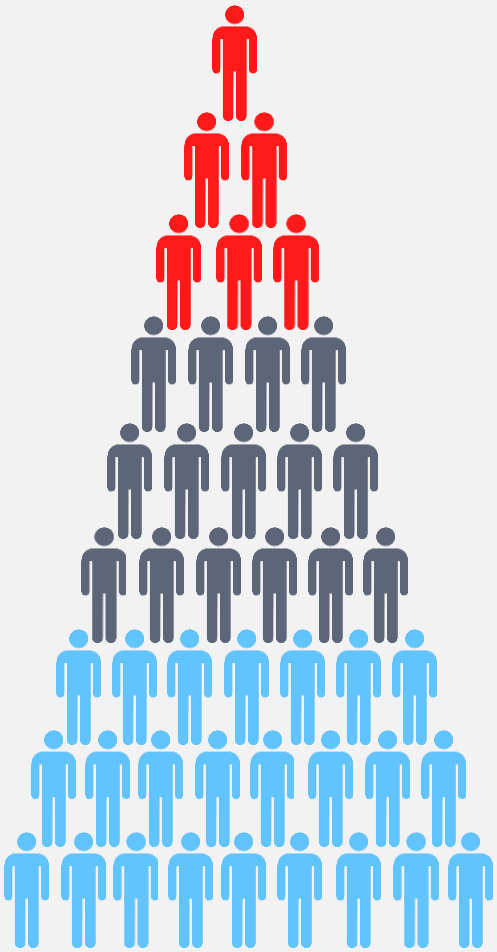
Traditional Transactional Care



Required Competencies

- Define and prioritize patient populations(e.g. risk stratifications).
- Identify and enable optimal interventions(e.g. decision support).
- Engage patients and caregivers(e.g. outreach and education).
- Monitor patient compliance and provider adherence to care plans.
- Assess outcomes(e.g. clinical, experience, financial, utilization, variance).

Population Driven Care



High Risk
Complex Care Team

Moderate Risk (Rising)
Care Manager/ Coordinator

Low Risk
Self-Management

- Proactive member outreach and engagement for preventative services

- Transitions in care
- Chronic disease management
- Address gaps in care

- Active case & disease management
- Transition in care
- Address gap in care
- Pharmacy Interventions

WHY RISK STRATIFY FOR YOUR PATIENTS

The value-care approach to health seeks to improve care outcomes while eliminating inefficiencies and reducing costs. Risk stratification is a tool to efficiently identify the best care options based on proven care outcomes in patients with similar risk factors. Through predictive analytics, providers can develop interventions based on population health data to mitigate these risks and improve outcomes. To be effective, predictive analytics must be timely, role-specific and actionable.

Improved Outcomes

A variety of data sources (EHRs, population health datasets, current vitals) compared to known risk stratifications will assist practitioners in classifying a patient´s risk for readmission. Furthermore, this will offer the doctor the most complete profile of the patient´s condition and the proven treatment options for said risk profile while filling in any potential knowledge gaps. This will assist the provider in prescribing the best care protocols to support the patient´s condition while reducing the risk of hospitalization. The earlier the provider and the patient can agree on a care regiment and determine the support necessary to deliver the best outcome, the greater likelihood of success.

Reduced inefficiencies

The risk stratifications will assist healthcare organizations to predict readmission rates allowing them to manage hospital utilization and the supporting resources needed based on the stratification. As risk profiles are developed in the model, proven care options will be associated with each risk profile improving care outcomes. Predictive risk scoring will allow care providers to prioritize high-risk cases, develop supporting workflows and staffing plans to preemptively monitor medication adherence, lifestyle factors, and follow-up appointments.

Lower Costs

Risk assessments will result in earlier interventions, precision treatment options, and greater patient engagement resulting in fewer readmissions and healthier patients. This will reduce the frequency of acute care scenarios thus driving down overall costs. Prioritizing our patient´s needs will further enhance the patient experience for greater member retention for providers.

BENEFITS OF USING STRATIFICATION

The use of risk stratification tools in combination with a care management plan can improve patient outcomes.

- Offers insights to provide levels of care that are tailored to an entire population and individual patients
- Maximize population/patient benefit at a given level of resources
- Permit providers to cope with versatility in care delivery by addressing patients across all acuity levels (health risks), accounting for prevalence and progression of different long-term medical conditions and accounting for regional differences in patient case-mix
- A means to inform policymakers, healthcare commissioners and medical specialists on expected outcome and expected (direct) costs on healthcare resource utilization for various intervention programs for an entire population or an individual patient.

BETTER STRATIFICATION WITH BETTER DATA QUALITY

Today's hospitals are overwhelmed with data from disparate sources.

- Most healthcare data is unstructured. Data exists in patient files, lab results, doctor's notes – rather than a standard format.
- Data quality is not reliable or available in real-time.
- There is not a universal patient identifier.
- Data often resides in legacy systems that do not communicate with other legacy systems.

Data that is not actionable is not useful. Therefore, healthcare organizations need seamless and patient-specific ways to integrate the data into platforms easily accessed by providers, care managers, and healthcare administrators.

HEALTHCARE DATA GROWTH

DATA AVAILABILITY

Operations must run and data be in a state of CONTINUOUS AVAILABILITY

24/7

365
DAYS A YEAR

HEALTHCARE IT BUDGET

Data storage constitutes more than

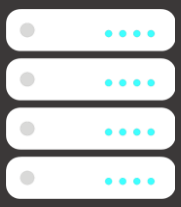
20%
OF THE BUDGET

DATA GROWTH

Healthcare data is growing at rate of

24/7
EACH YEAR

Electronic health data in the healthcare industry by 2020 is expected to grow to



25,000
PETABYTES

In 2015 it will generate over

600 TB+
OF DATA

The average hospital has

800,000
PATIENT RECORDS

CURRENT RISK STRATIFICATION MODELS

Risk stratification models have traditionally used medical and pharmacy claims data combined with other sources, such as electronic health records (EHRs) to identify patients at risk. Unfortunately, providers do not always have access to all claims for their attributed populations within an actionable timeframe.

Some of the more well-known and utilized models to analyze and predict risk include:

- Hierarchical Condition Categories (HCCs) — developed by the CMS Medicare Advantage program to classify patient risk by grouping health conditions that use comparable resources into 70 categories. Each HCC receives a weight that impacts the patient's risk score. This model is useful for Medicare Advantage but not sufficient for care management applications.
- Johns Hopkins Adjusted Clinical Groups (ACGs) — predicts a person's health over time with existing claims, EHR and demographic data, and helps understand health needs of a population or subgroup.
- Elder Risk Assessment — assigns a risk score to people 60 years and older using demographic data.
- Chronic Co-morbidity Count (CCC) — using public data from the Agency for Healthcare Research and Quality (AHRQ), this model measures select comorbid conditions in six categories

Existing models were built for actuarial purposes - to quantify risk. They were not built to manage care delivery and resource allocation. Existing stratification models are not designed to incorporate the voluminous amounts of data produced by today´s healthcare environment. Furthermore, studies have shown profiles developed based on these traditional models only account for 10 percent of a patient´s health outcome.

In today´s value-based care environment, new stratification models need to quickly assess the patient to determine the right information to deliver the right care at the right time. The new models need to address the future needs of healthcare organizations by including real-time data along with patients' social determinants of health. Healthcare organizations must, therefore, incorporate information about social, behavioral, and environmental factors into their risk stratification models in order to better understand a patient's total active risk to best determine the right care options.

Social determinants of health are factors in which we live that impact a wide range of health conditions. It is estimated that social determinants account for seventy percent of health outcomes. By incorporating broader data sets, providers can identify more care gaps than they would in a traditional risk model. In addition, healthcare organizations can gain better insight into individual drivers of patient engagement, which can help providers match patients to interventions, services, or resources that are most likely to improve outcomes.


Predict Risks
Prioritize Interventions
Patient Engagement
Preventive Care
Communicate
Rest/ Sleep
Nutrition
Exercise

SOCIAL DETERMINANTS INCLUDE

- Safe Housing
- Clean Water
- Healthy Food Options
- Access to Healthcare
- Educational, Economic, and Job Opportunities
- Transportation Options

Risk stratification needs to consider a variety of environmental factors that influence a patient`s health including social determinants, lifestyle choices, and mental health to create a holistic patient profile form which to glean predictions into patient health. Further, it is important to understand the financial and logistical challenges that exist that may prevent a patient from regularly seeking preventative care or complying with their prescribed treatments.

By developing risk scores that include a blend of social, behavioral, and clinical data, providers will gain full insights into a patient´s risk profile and be better positioned to create appropriate care plans to meet their needs.

STRATEGIES FOR RISK STRATIFICATION MODEL DEVELOPMENT

Risk stratification is a screening tool using prognostic predictors to assist providers in making informed decisions relative to treatment options.

Risk prediction models are used in clinical decision making to assist healthcare teams and patients make informed choices about treatment options. Statistical models are used to predict how a patient with a given set of risk factors (current health event, comorbidity factors, and patient history) is likely to respond to various types of treatments and what care outcome is to be expected. Often, there may be existing evidence (from published risk models, meta-analysis, and expert opinion) that will guide the care team in prescribing certain courses of treatment.

When new predictors are introduced, or the condition variables are unique, the need for a new risk stratification model may exist.

The initial development of a risk model begins with a systematic review of historical data and studies pertaining to the outcome to assess. These historical data sets in conjunction with consultation with clinical experts begin to identify a set of candidate predictors.

Getting participating clinical stakeholders to agree on what is the right way to measure risk, classify patients into a risk category, and identify which predictable variables are appropriate can be a challenge. Providers will often differ on how to weigh risk factors, the best course of treatment, or the level of patient engagement. Patients are encouraged to get a second opinion, and a third and a fourth - leading to further confusion and frustration. The intent of risk stratification is to correctly identify the potential for risk and deliver the most appropriate response to mitigate said risk.

MODEL DEVELOPMENT

When developing risk stratification models, the first step is to define the patient population and the particular risk to be identified. For example, the risk of readmission of males over 60 following an angioplasty. This allows payers and providers to understand the potential risk factors from which to develop recommended treatment protocols and to define the benchmarks of success.

- Identify the outcome to be measured – for example, readmission from complications from surgery.
- Determine the predictor variables to be considered – sex, age, health history, condition. Standard regression methods then calculate the individual's risk of the occurrence readmission. The model is then validated over a patient population for accuracy and adjusted where necessary.
- Health care practitioners were more likely to embrace new methods of case finding if they were consulted at every stage. If they could see a clear benefit to their own patients, they were much more prepared to make some of the changes in practice required and less likely to see risk stratification tools as an attack on the clinical judgment.
- Adoption by clinicians is enhanced by user-friendly portals so that health practitioners and, where possible, patients could access useful information, often linked to decision aids relevant to the patient's risk.
- Data protection and privacy issues need to be addressed early in the development process.

A successful stratification tool must demonstrate good validation and prognostic strength. AI can help care providers align patients with care plans. This allows them to deal with co-morbidities and complex, patient-specific contexts, instead of standard clinical pathways that can only focus on one disease at a time.

ENGAGING PATIENTS FOR BETTER HEALTH MANAGEMENT

AI has demonstrated the ability to identify early risk indicators in advance of traditional means. These indicators allow healthcare providers to deploy predictive interventions for better outcomes. Once a risk has been identified, patient engagement is essential for better health management.

It is proven that poor lifestyle choices, such as an unhealthy diet, drinking, or not exercising, are key contributors to the progression of preventable chronic diseases including obesity, diabetes, hypertension, heart disease and several types of cancer. The benefits of lifestyle changes are readily understood by most patients but can be difficult to adhere to. Healthcare organizations need to develop wellness programs that encourage and support healthy behaviors such as nutritional counseling, exercise training, and stress management techniques.

Ensuring the right patient receives the right intervention at the right time is the end goal of patient engagement. The power of identifying patients at risk and the capacity of the health system to proactively deal with these patients is a powerful combination to improve quality and efficiency at the health system level.

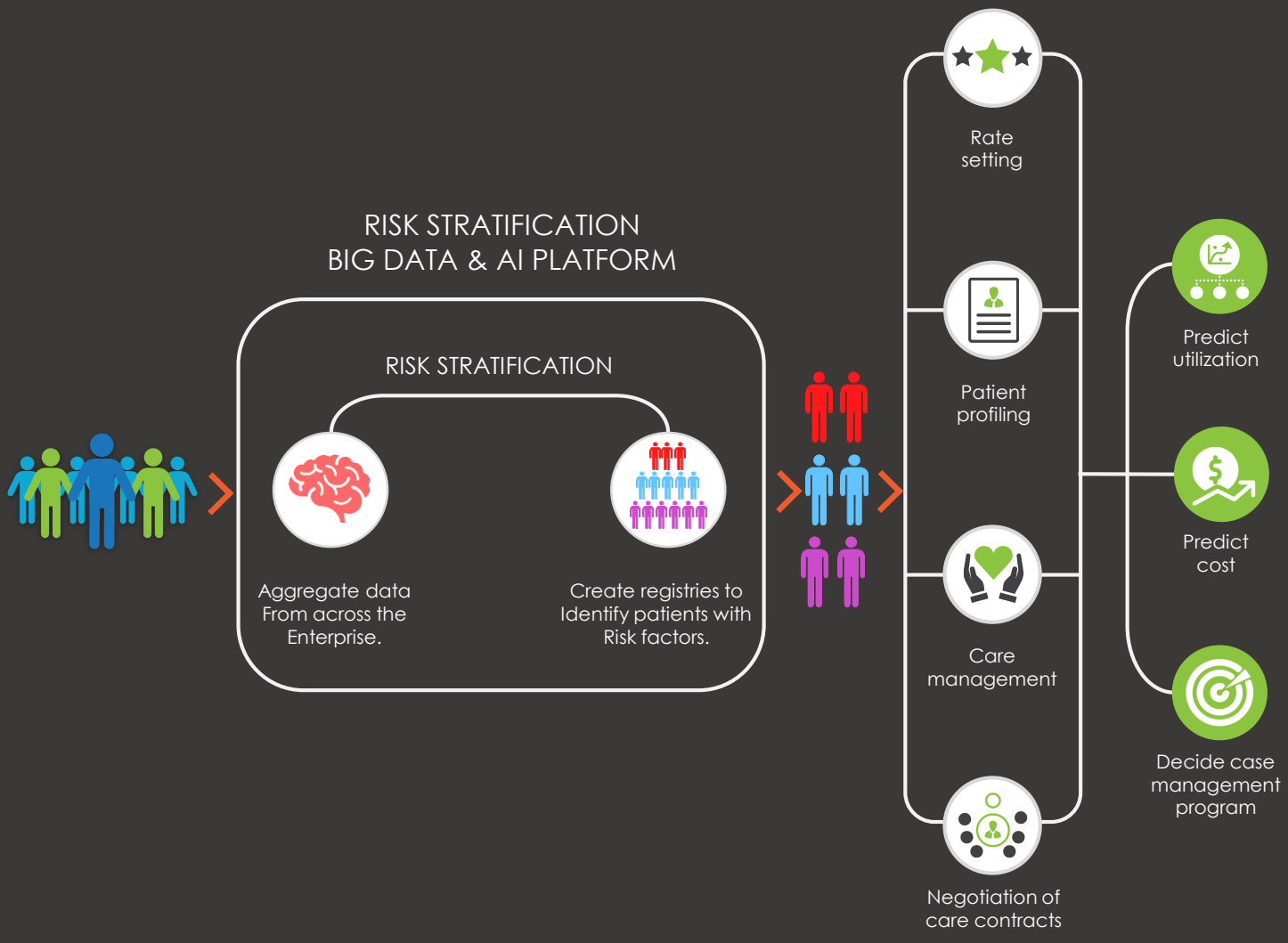
BIG DATA AND AI IN PATIENT RISK STRATIFICATION AND CARE COORDINATION

Big Data Analytics couple with machine learning can analyze large data sets to better understand primary risk factors and impact of comorbidity conditions to develop intervention strategies to delay or prevent disease progression.

Big Data offers the opportunity to develop even greater precision of risk stratification. Disparate data sets from various institutions can be loaded into a data lake to create even large data sets to assess. The universe of data is no longer limited to a single study or providing institution. Obviously, the more data available to analyze results in more precise insights.

Artificial Intelligence will learn from these insights and begin to link care coordination with risk stratification. All clinical stakeholders from primary care to specialists will understand the patient´s needs and preferences resulting in a better patient experience and improved outcomes.

Enhanced care coordination will ensure providers are operating with real-time data offering the latest intervention strategies and treatment protocols given the patient´s risk factor. These insights will be used to provide safe, appropriate and effective care to the patient.



IMPROVING PROACTIVE CARE WITH RISK STRATIFICATION

Target

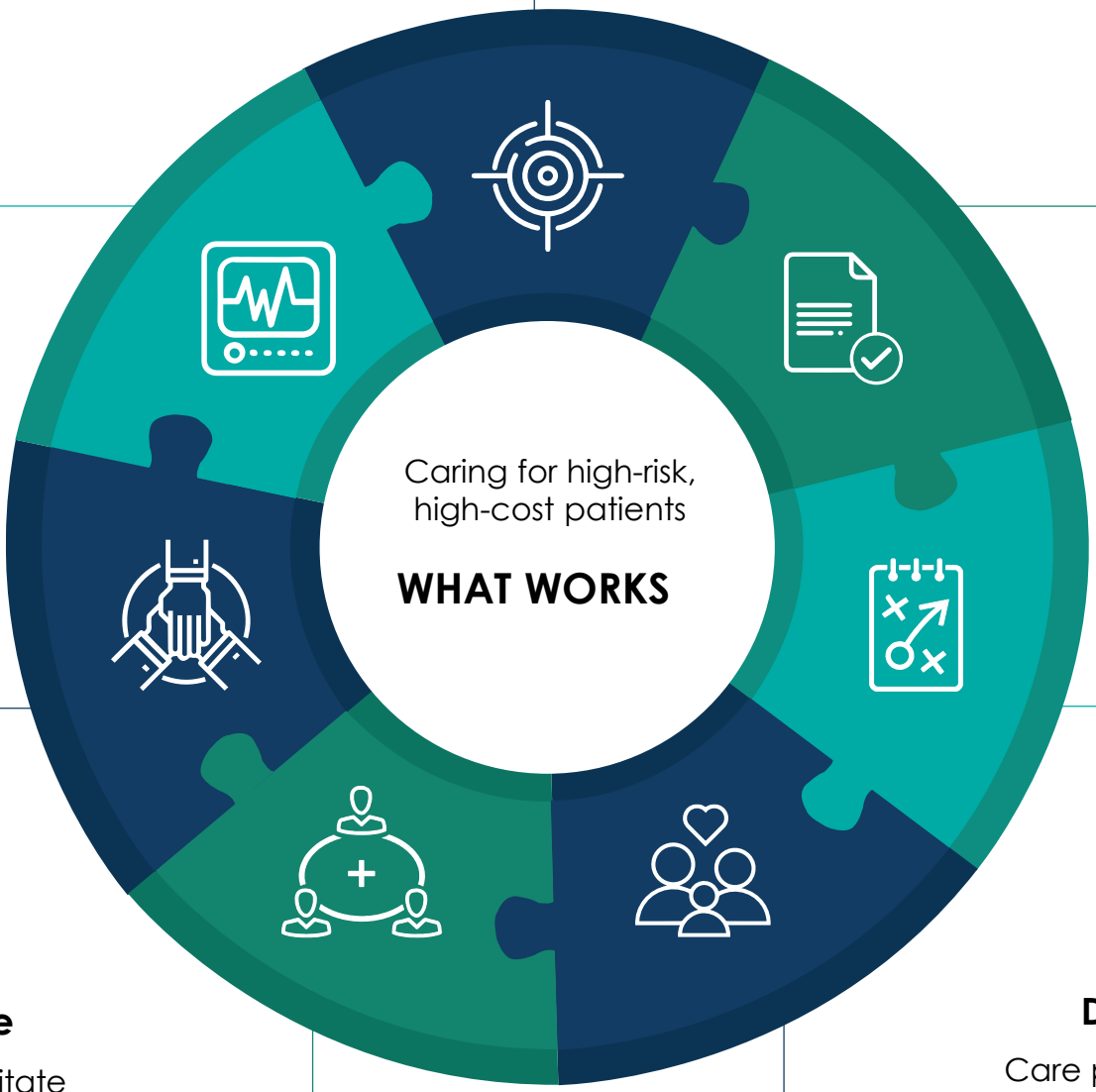
The population most likely to benefit

Assess

Patients health-related risks and needs

Monitor

Progress



Coordinate

Care and facilitate communication among all care providers

Develop

Care plan centered around patients' needs and preferences

Connect

Patients to appropriate follow-up and support services after hospital discharge

Engage

Patients and family members in managing care

FUTURE OF RISK SEGMENTATION

Risk stratification tools are used to refer to all models, tools and systems that use algorithms to predict future risk of mortality, morbidity or health service usage (including hospitalization, re-hospitalization and pre-hospital service usage) for a particular defined population.

The challenge is to leverage machine learning, AI and other analytics to create decision support algorithms and data context that creates real value.

AI will result in more precise risk stratifications to better understand the patient's risk factors. The future of risk stratification will be about building even greater data sets incorporating more predictor factors. When a patient presents, regardless of individual history, providers will have a wider spectrum to consider when performing a risk assessment. This will lead to earlier interventions, improved outcomes and a reduced need for acute care.

Digital health solutions are changing how providers deliver health care. From machine learning to identify early disease indicators to telehealth solutions to expand access to treatment, healthcare providers are beginning to realize the benefits of technology. With a continued focus on value care, doctors are intervening earlier to address mental health concerns to avoid acute care scenarios whenever possible. Risk stratification offers screening tools to efficiently identify a patient's risk factors.

AI Enhanced Risk Stratification Powers Value-based Care

In treating patients, doctors look at an existing condition, and seek a proven course of treatment. Finding the right treatment at the right time is essential for successful outcomes. This is further complicated when a patient suffers from multiple conditions. The additional conditions present multiple risk factors when considering treatment options. Risk stratification builds algorithmic models to better understand the impact on risk when comorbidity exists (the presence of one or more additional diseases or disorders co-occurring with the primary disease or disorder). These models assist healthcare teams to prescribe proven treatment options based on the risk factors present.

The more data we can feed these models, theoretically the more accurate the risk assessment. In addition to comorbidity factors, these models should incorporate social determinates, as well. While hospitals and other organizations produce terabytes of data they are unable to harness it to develop valuable insights. Predictive insights are still locked in the unstructured data residing in disparate legacy systems and other sources.

Data Analytics can harness these data sources offering valuable data sets for risk stratification modeling. Machine learning can improve these models creating better risk assessment tools. With advanced risk stratification models, providers will be empowered to predict, prioritize and prevent disease progression for better health outcomes.

About Scalable Health

Scalable Health is healthcare division of Scalable Digital focused on providing innovative products and solutions in healthcare and life sciences market.
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