Going Beyond Genomics in Precision Medicine: What's Next
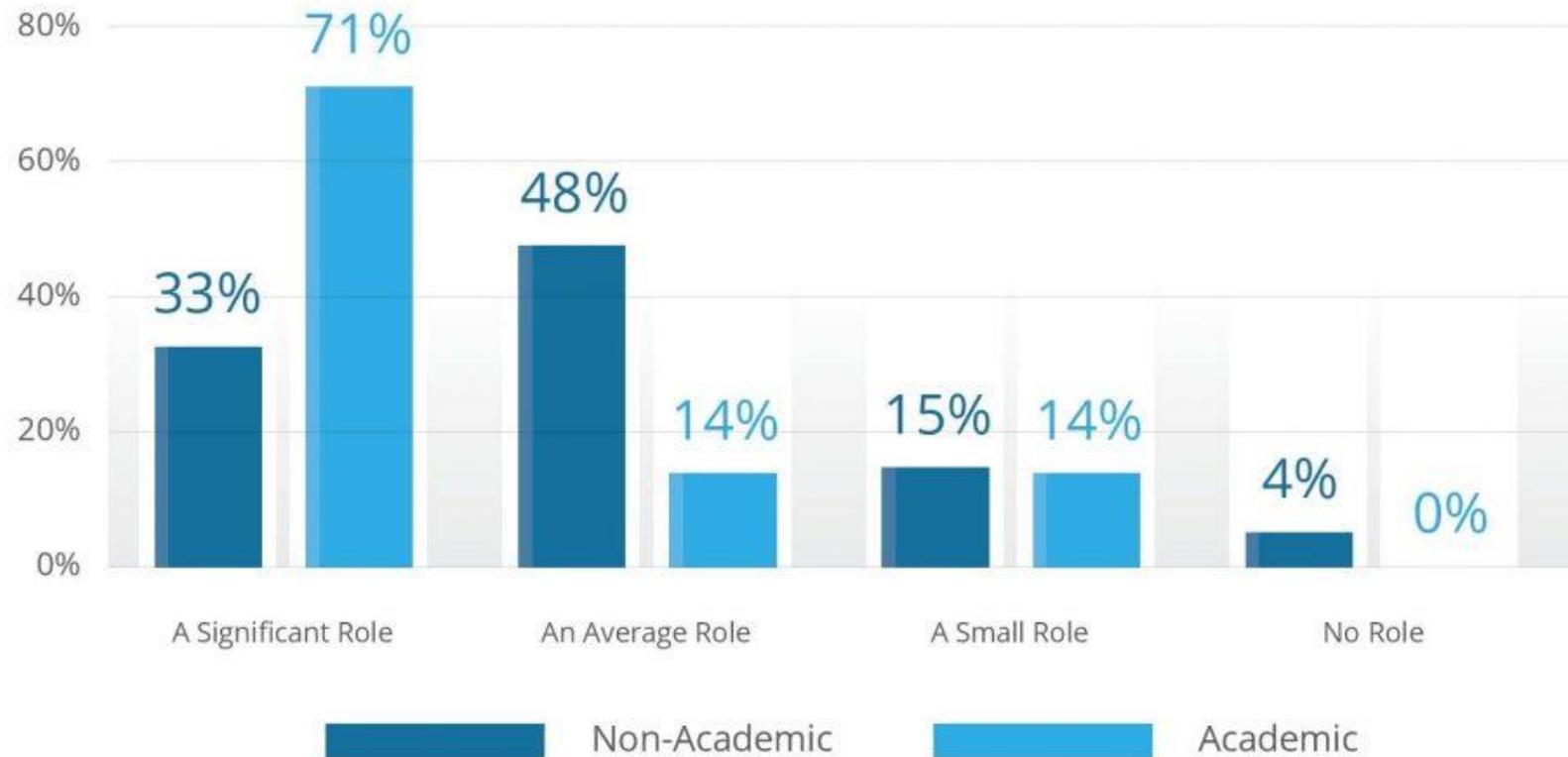
David Crockett

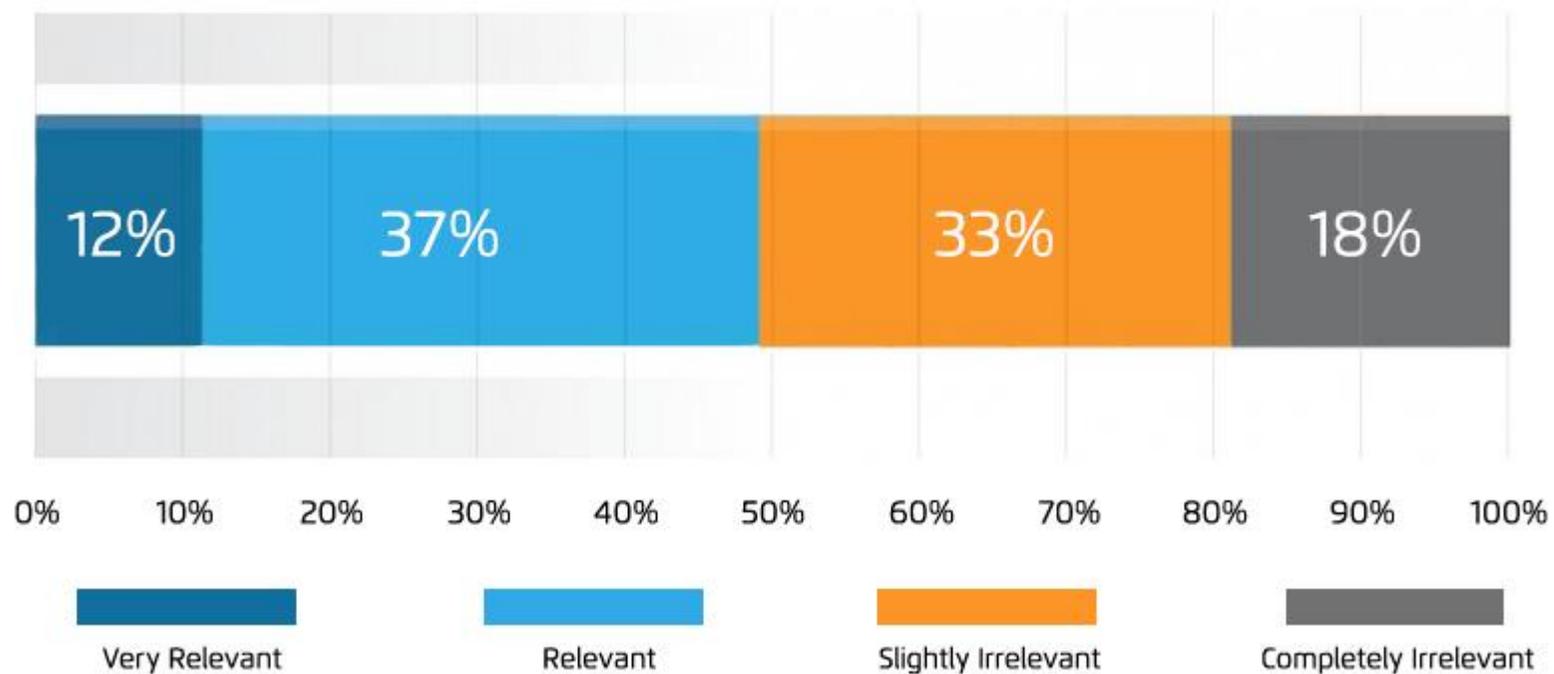Posted in Healthcare Transformation and Precision Medicine.

ADDED

As we've learned from our 2016 survey, many healthcare organizations seem to have more pressing challenges to face than embracing the paradigm of precision medicine. The demands of changing cost models, decreasing reimbursement, avoiding CMS penalties, and merger/acquisition pressures threaten to overwhelm numerous health systems. Thus, when we asked healthcare leaders across the nation, a majority responded that integrating genomic data into the records was a low priority. Some groups even responded that genetic information from patients was irrelevant to their health systems.

How Significant a Role Will Precision Medicine Play in Your Organization Over the Next Five Years?

	A Significant Role	An Average Role	A Small Role	No Role
Non-Academic	33%	48%	15%	4%
Academic	71%	14%	14%	0%

How Relevant is DNA Sequencing to Your Organization's Patient Treatment Strategy?

| 12% | 37% | 33% | 18% |

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Very Relevant | Relevant | Slightly Irrelevant | Completely Irrelevant

We should be clear. Precision medicine is not only about "-omics" (genomics, proteomics, metabolomics). It is really about "economics." It is about improving patient lives.

The time is quickly approaching when healthcare consumers (i.e., all of us) will begin asking, "Why can't my doctor say something like this…?"

I can give you an optimized health recommendation based on five components:
1) data from recent clinical trials;
2) information about local and regional patients similar to you;
3) actual health outcomes of every patient like you who has had your illness;
4) your level of your interest in participating in your own care;
5) your ability to participate in your own care.
In turn, I can tell you within a quantified range of certainty, which treatment is most likely to succeed specifically for you and how much that treatment will likely cost.

That is precise medicine.

The Elusive Paradigm of Precision Medicine

For us, precision medicine simply means that patients are quickly and appropriately placed into the path of care that is most effective and cost efficient for them at that time.

Diagnostic Gradient

One clear obstacle to precisely diagnosing and treating diseases is the dilemma of "diagnostic gradient." Many disease conditions are relatively straightforward to identify with a distinct biological cause, a direct clinical measure or a clear diagnostic image. Unfortunately, others disease conditions have only indirect markers or require more extensive observation and rule out testing—sometimes referred to as a diagnostic odyssey. The chief complaint of this diagnostic gradient is diagnostic error. In a September 2015 Institute of Medicine report Improving Diagnosis in Healthcare, a diagnostic error is described as "[in]accurate if it differs from the true condition a patient has (or does not have) or if it is imprecise and incomplete." The consequence of diagnostic gradient and diagnostic errors is imprecise medicine.

Multi-Morbidity

To further compound the complexity of this diagnostic gradient, the aging population in our country has increasingly overlapping and co-existing conditions as seen in Figure 1. Patients with multi-morbidity and difficult-to-diagnose conditions will often need to visit multiple physicians, which can further fragment their data ecosystem. This multi-morbidity is troublesome at all levels of healthcare.
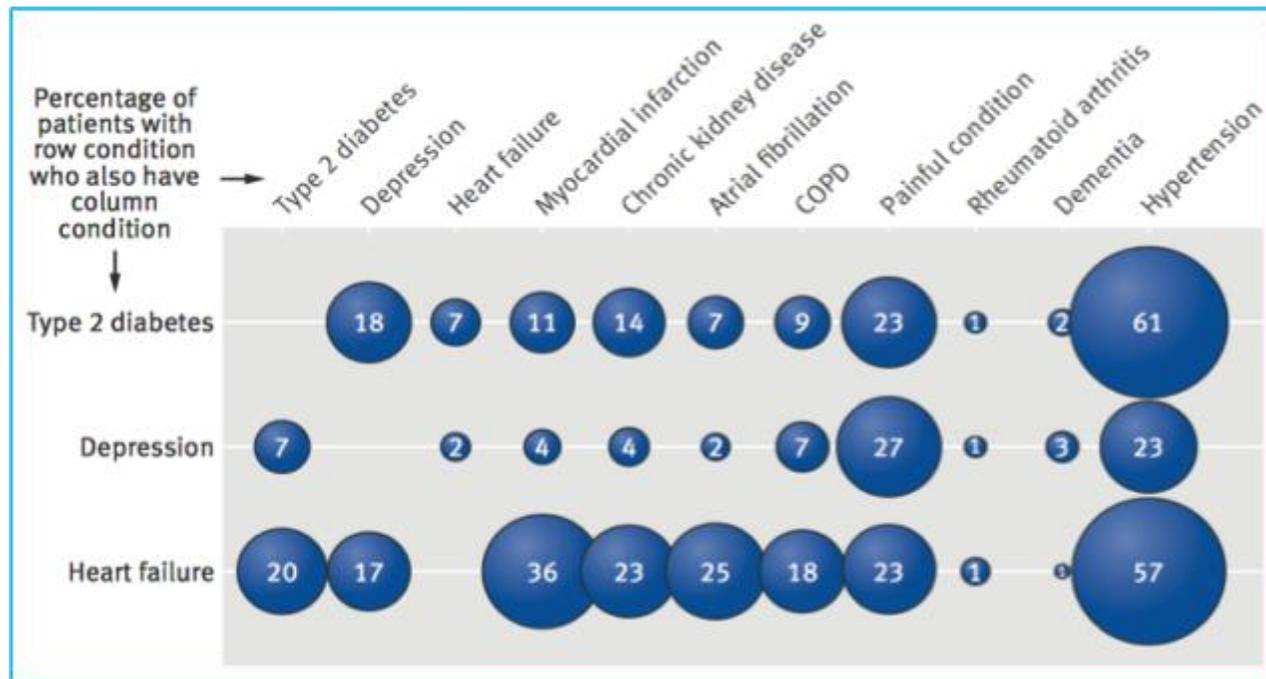

Figure 1: Patients often have overlapping co-morbid conditions. (Source: Dumbreck and others, Drug-disease and drug-drug interactions, BMJ, 2015)

More Precise and Comprehensive Patient Data

Another vexing obstacle is how to get a more complete view of a patient's health status than is provided in most electronic health records. To accomplish this, we need behavioral, environmental, and socio-economic data, all of which contribute to understanding a patient's overall health and risk factors. This means fully leveraging any available patient data within the health system, as well as relevant data from outside the health system. This is not [big data](). This is simply using more comprehensive and more precise data to increase our understanding of the most effective treatments for a patient.

Health Catalyst is actively working to build this more comprehensive patient data ecosystem. Our re-useable data modules are feature-engineered to include input elements such as mental health, polypharmacy, palliative care, socio-economic indicators, and geo-based risk. For example, Figure 2 details one of our new data modules we call INSIGHT (Independent Neighborhood Socio-economic Indicators for Geo-based Health Trends), which leverages publicly available data on U.S. mortality rates and U.S. Census data from housing, education, and income across more than three decades. This risk of mortality can be viewed across county, zip code, and neighborhood levels. INSIGHT can be used to build more comprehensive risk models that combine patient clinical data with socio-economic data.
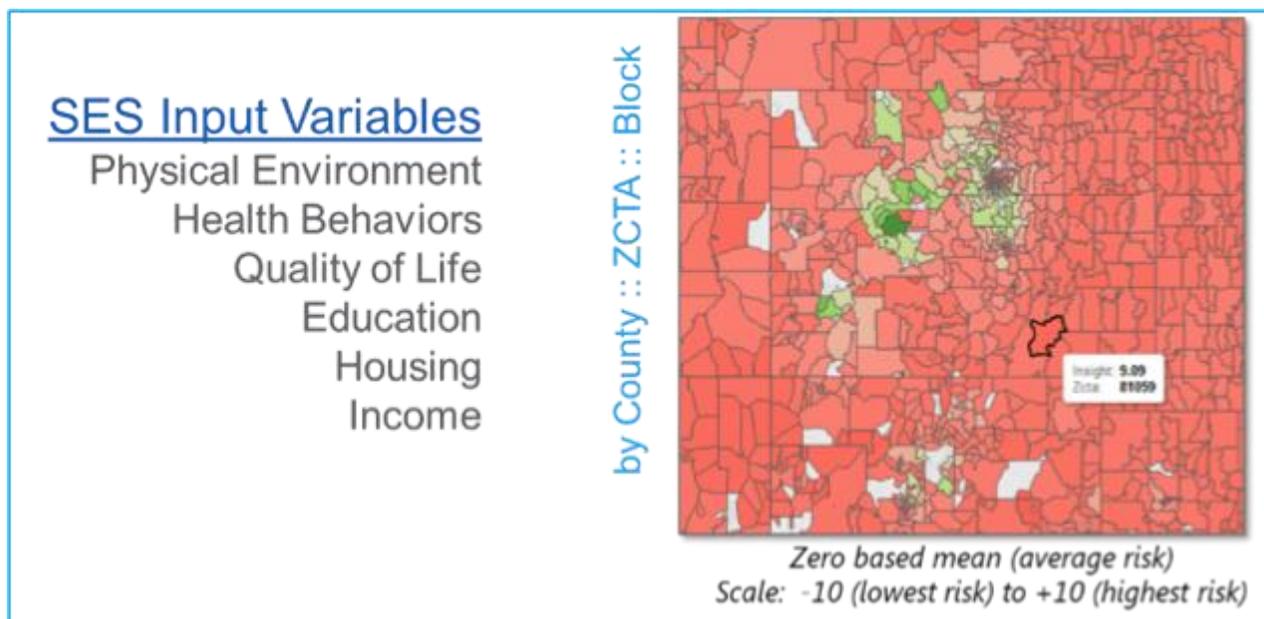
Figure 2: Socio-economic data is used for insight into geo-based risk of mortality across county, zip code, and neighborhoods in the U.S.

The Next Big Leap in Healthcare

There have been several decades of increasing electronic capability in our healthcare environment. Electronic data and computers have become firmly entrenched in the workflow of patient care. Despite this steady march forward in technology, we have yet to seamlessly capture health outcomes and integrate transparent cost and a complete data ecology of a person. Closing the loop between available data, existing workflow, and clinical decision making, will lead to more precise medicine. It will also serve to close the loop between data internal to the EMR and externally available patient data. This embedded and in-context decision support, known as closed-loop analytics, will be the next big leap in healthcare as shown in Figure 3.
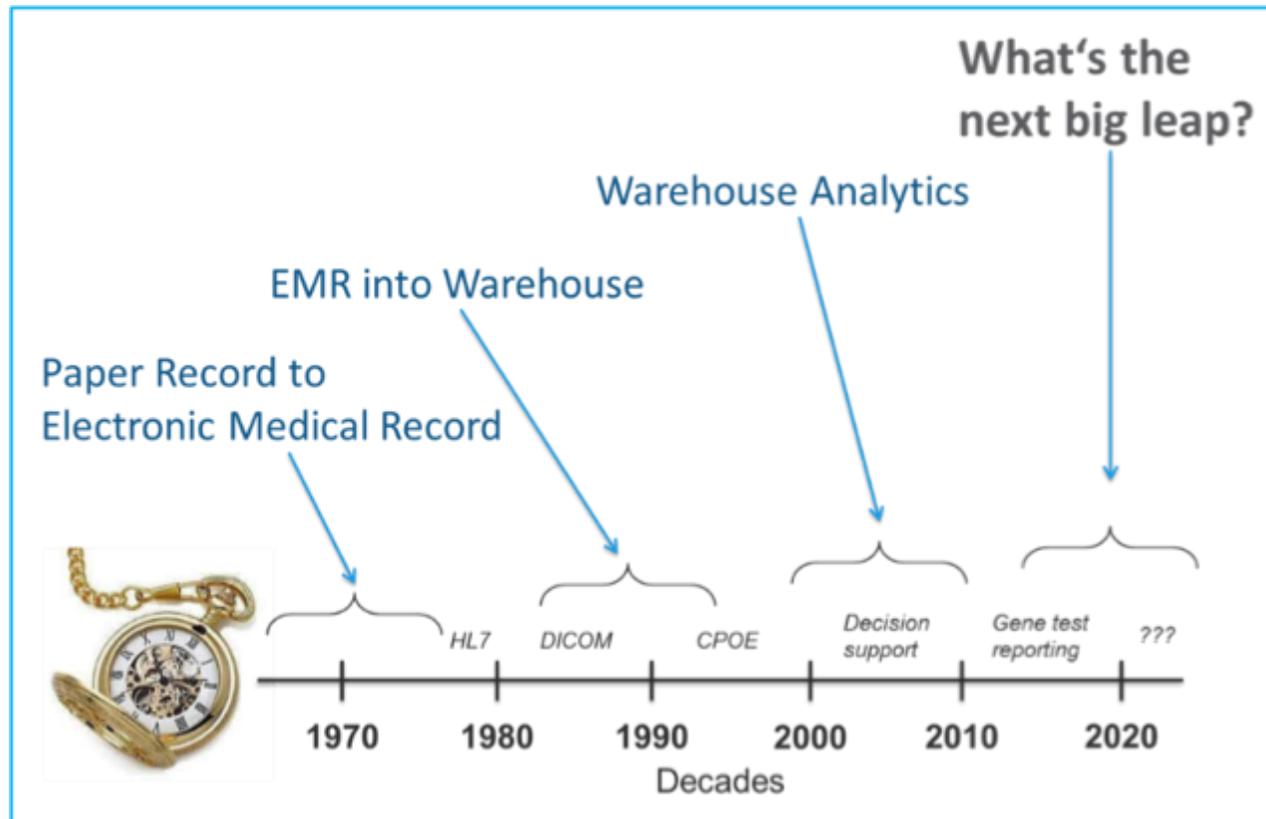
Figure 3: Decades of advances in the electronic capability of our healthcare environment.

Closed-loop Analytics and How It Leads to More Precise Medicine

Precision medicine is not only about accurate diagnosis and treatment but *timely* diagnosis and treatment, as well. That's where closed-loop analytics comes in to play. In terms of treating a patient effectively, the primary goal of closed-loop analytics is decreasing the time from insight to decision to action. And because necessary data is found both internal and external to a health

system, closed-loop analytics within a robust data warehouse environment will always be superior to standalone or siloed applications.

While the traditional delivery of medicine is often linear from observation and data to decision, a more precise way to effective treatment is closing the loop between workflow, data, and action (Figure 4). Closed-loop analytics refers to individuals generating data that are used to produce metrics, analytics, or visualizations that are then acted on in one or more interventions. It is the confluence of EHR system tools, decision support tools, and reporting and analytics, all used to improve patient outcomes and reduce cost. Analytics and decision support are most effective at the point of care and when shown in an existing workflow directly to the decision maker. Similar to disease surveillance or immunization in public health, closed loop analytics can also lend insight into the entire patient lifecycle, not just point of care.
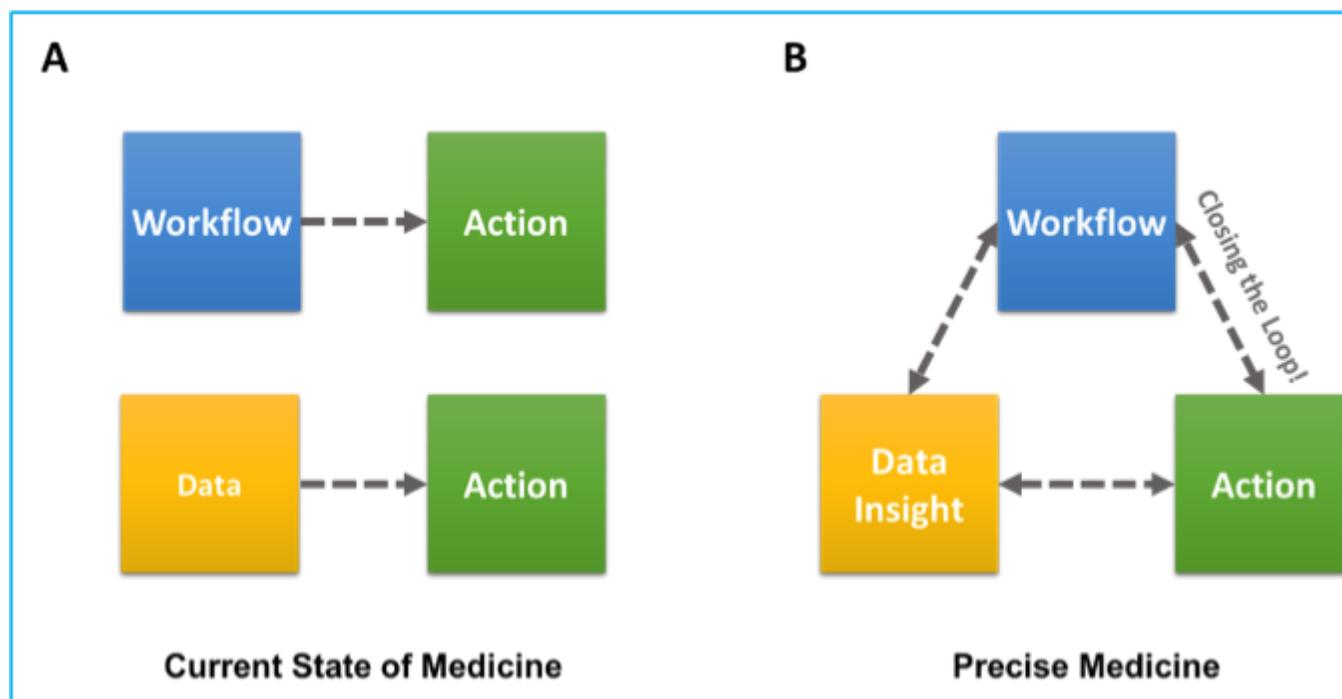
Figure 4: The current state of medicine follows a linear path from workflow to action and from data to action. A more precise way to deliver care is closing the loop between workflow, insights from data, and action.

Closed-loop analytics is much more effective than a manual process for point-of-care decision support. Published literature overwhelmingly reports that clinical decision support interventions succeed when the information is provided to clinicians within their natural workflow – at the point of decision-making. Conversely, decision support does not succeed when clinicians are required to seek out the advice. When point-of-care interventions are presented automatically and fit into the workflow of the clinicians, those recommendation are more likely to be used. Furthermore, it is also more effective to provide recommended actions for the decision maker instead of simply showing an assessment. Finally, interventions that provide information at the time and place of decision making are more likely to have an impact on patient health and overall costs.

At the heart of delivering precision medicine, closed-loop analytics provides an effective way to activate all available data to improve patients' lives and pinpoint their healthcare costs.

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