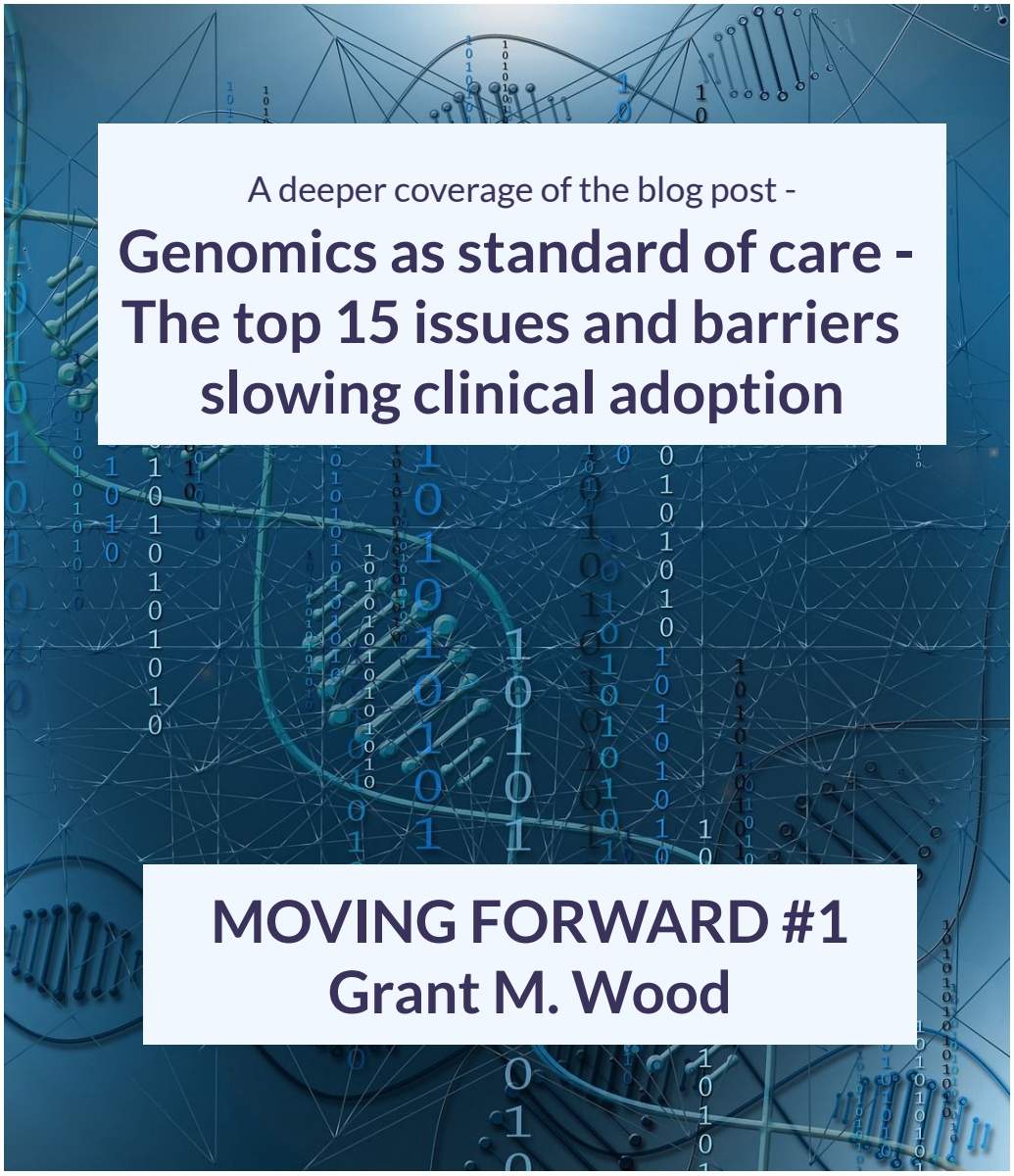

A deeper coverage of the blog post -

Genomics as standard of care - The top 15 issues and barriers slowing clinical adoption

MOVING FORWARD #1

Grant M. Wood

A Comprehensive Review and Perspective Report

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Introduction

Clinical genomics promises to revolutionize healthcare by providing personalized treatment options based on a patient's unique genetic makeup.

Genomic information applied in the clinic is a powerful tool that can help us understand the genetic basis of disease, a patient's risk for that disease, and what the best treatment might be, but it is lagging behind other areas of medicine in terms of clinical adoption. The question is: what are the barriers slowing down the adoption of clinical genomics and making it standard of care? Genomic medicine, like any emerging technology, faces many challenges. This white paper will provide an overview of key issues to enable stakeholder discussion around the standards, protocols, workflow processes, and strategies that will be required to access, exchange, store, and integrate genomic data, as well as the associated business, clinical, legal, technical, and ethical issues that will be encountered within and between health care systems, care providers, and insurers. We will examine the major issues affecting clinical adoption and then discuss what needs to happen next.

My experience

Beginning in 2005, with a new employer, our small but eager clinical genomics group set out to make genomics standard of care. However, years would pass without that goal being realized.

I eventually figured out why, but the 'official' explanation was that there were too many competing system priorities that required all of the available funding and resources. To add to the internally caused roadblocks, the Meaningful Use program by the U.S. Federal government, which started in 2011, forced most IT budgets to focus on compliance. During those years, there was plenty of incentive money in the billions of dollars, but none spent on genomics. If clinicians used genetic testing, it was their own decision.

There was no system-wide clinical genomics program. The exception in the U.S. was a small number of forward-thinking systems with the budget and inclination to be on the leading edge. Certain specialty clinical programs (oncology, cardiovascular disease, and maternal and fetal medicine) would soon have a genetics strategy, but they did not function and collaborate on the enterprise level with all the various healthcare-delivery departments.

Genetic testing and related services were doctor- or specialty-centered and not patient-centered. (More on genetic care coordination in a later post.)

The previous two paragraphs contain only a small portion of my experience. I bet many readers are nodding their heads in agreement, as they have also gone through similar difficult paths. So let us take a high-level view of this question with unperturbed, inspired, and prepared eyes.

15 Issues and barriers

Most genetic services offered to patients begin with individual physicians looking for new diagnostics to advance their patient care and improve clinical outcomes. However, at the health care system level, the administrators seem to only follow kicking, screaming, and complaining the whole way. They, of course, have other priorities that they believe will have a greater impact on the bottom line.

Building a comprehensive clinical genomics program is a highly complex activity. There are many publications on this question that present different perspectives and answers, and I suggest consulting them. However, based on my experience, studies, and industry observations, I found that this list of issues and barriers will cover the topic in a thorough manner. These 15 items should be thoughtfully reviewed, followed by plans to solve each, all while including the clinical genomics champions and motivated stakeholders across the entire enterprise.

After reading this list, see the call-to-action statement that follows and respond with how we should accomplish the action. Also, please take a few minutes to fill out a survey, which will be described in more detail later in the document.

Building a comprehensive clinical genomics program is a highly complex activity. Based on my experience, studies, and industry observations, I found this list of 15 issues and barriers will cover the topic in a thorough manner.

1. **Establishing medical necessity**

Do we need genomic data to make a diagnosis? Or are there other ways of getting the same information? Is this information useful for treatment decisions and clinically actionable? What are the risks and benefits of genomic testing? What policies for test ordering and new clinical protocols need to be formalized? These questions need to be reviewed before the healthcare system begins its journey toward using genetic and genomic sequencing as standard of care.

If you're considering using genetic analysis in medical practice, it's important that you're able to justify your decision with clear arguments for why this is medically necessary. Starting with a thorough medical history, then ordering additional tests, such as blood tests or imaging studies, may help to confirm or rule out a suspected genetic condition. Following that, the clinical reasons for testing should match the need for diagnosing inherited genetic disorders, carrier, predictive, and prenatal testing, somatic testing for cancer treatments, pharmacogenomics, and newborn screening.

2. Evidence-based guidelines are not fully developed

There are evidence-based guidelines available for genetic testing, but the availability and quality of these guidelines can vary depending on the medical condition being tested and which genetic test is chosen. Whereas some modalities are well established, other clinical areas may need to update guidance based on ongoing research. When test results are returned, there are limited guidelines for how to interpret and use genomic information in clinical decision-making. This can make it difficult for healthcare providers to incorporate genomics into their workflow.

3. Clinical utility data

For clinicians to adopt genomic testing, they need to know the specific test they order will be useful in making a diagnosis or guiding treatment decisions. Clinical utility data can help them determine whether this is true. Clinical utility data provides insight into how well a test performs in clinical settings and how it compares with diagnostic tests developed at competing labs, and other patient management strategies. It also allows medical economists to determine the cost-effectiveness of different genomic tests by calculating their return on investment (ROI)—the ratio between money spent on a genetic test and its benefits over time. The science of this analysis is still evolving as more data becomes available.

4. Provider and patient education and training.

Genomics is a new field, and many healthcare professionals are not yet up to speed on the latest genomic findings or how to integrate them into clinical practice. Some healthcare providers still do not have the knowledge or training to interpret and use genomic information in clinical decision-making. Patients must also be educated on how genetics fits into their care, which may include talking about genetic testing options with their doctors, understanding what the results mean and how they might influence treatment plans and lifestyle choices, as well as learning more about the potential impact of genetic variants on other family members.

5. Clinical workflow

The effect of genomics on clinical workflow is a critical component of the whole plan. If clinicians are already having trouble integrating basic clinical data into their daily workflow, it will be crucial to figure out how genomic-based care coordination
can help with care delivery and management without completely overwhelming care teams. Healthcare providers require quick access to test reports, must deal with both false-positive and false-negative results, or worse, a lab classification of a variant of uncertain significance. In the latter case, the provider needs an automated process to update the reclassification of variants in the patient record, with guidance as to how the change affects patient management. And finally, even with all this, they must consider their ultimate responsibility and liability for the genetic test results.

6. Genetic counseling programs

Genetic counselors (GCs) are essential to supporting physicians in delivering optimized genomics-based care. Even though they are few in number, health care systems still underpay them, so they go outside of health care delivery and into industry (mostly commercial testing services). Additionally, many of these systems do not provide the necessary computerized applications that support genetic counseling processes. GCs are on their own to find patient management applications or devise their own solutions. An obvious piece of evidence for this issue is that most health care systems lack an enterprise-wide family health history program that focuses on both individual and family risk for genetic disorders.

7. Cost, coverage, and reimbursement.
Genomic testing costs have decreased substantially, which will eliminate a barrier for patients, health plans, and even healthcare providers. Reimbursement for genetic and genomic testing and related services is a business issue, while clinical utility is a clinical issue. Reimbursement is important for the business administrator and the payer, but clinical utility is important for the clinician and the patient. As we've seen with covering the cost of other new medical technologies, health plans want to see evidence showing that the technology results in better outcomes compared with current standards of care.

However, the issue does remain with insurance companies having different policies for coverage and reimbursement. Too often this gets in the way of decision-making about how best to treat the patient. A health insurance industry survey found that genetic testing was the third most common treatment for prior authorization (86%) behind specialty drugs (98%) and high-tech imaging (89%). A streamlined test selection, pre-authorization, and test ordering process is required to solve this problem. (This article has an informative discussion on the matter.)

8. Data sharing and security issues.
The storing and sharing of genomic data is not only a challenge but also a responsibility. Both are in terms of how to get consent from patients and providers, and ensure that the data is properly secured, but also accessible to patients and other consented users (other clinicians, other health care systems, clinical trials, academic research, national studies, and most importantly, other family members). Genomic data uses the same security technologies that are used for the general patient record. Lifetime genomic data retention also requires policies covering privacy, confidentiality, and data ownership.

9. Technical foundation

Hardware, software, lab data interfaces, EHR interoperability, genomic data quality, data management and governance, analysis, visualization, and the technical talent to manage it all, are important technical requirements that slow the clinical adoption of clinical genomics. While many technologies exist to help address these necessities, including tools for mapping genomic variants onto clinical phenotypes, there are still many issues remaining - IT staffing and funding being primary among them.

The staff should also include medical informaticists and bioinformaticists. The health care system should build a capability for technology innovation and not just maintenance. Much of this technical expertise can be outsourced. If this is too much, the system can partner with or outsource much of the technology platform and services to others.

10. Complexity of genomic data.

Genomic data is complex and requires specialized expertise to interpret and use in clinical decision-making. Data integration challenges become further magnified with genetic and genomic test results, which are generated as an unstructured PDF attachment to a medical record, thereby limiting the extent to which data can be used by clinical decision support systems. With guidance from bioinformaticists, a genomic data repository should be built with the ability to query any chromosome or gene down to the level of the single nucleotide polymorphism (SNP). The repository should contain the patient's whole genome, and not just the much smaller variant call file (VCF).

Whole genomes and their annotated data generated from a sequencing laboratory are too large to store directly in an EHR. This repository needs to be separate but linked to the EHR. (See the description of a GACS repository.) To fully complete this step, additional datasets should support the creation of a patient's multiomic profile - starting with the patient's genome, but then adding the proteome, transcriptome, metabolome, epigenome, microbiome, and any other biomarkers. To make it complete, this dataset should also be linked to an external family health history repository.

11. Lab reporting systems and interpretation of results

Laboratory information systems used by the ordering healthcare provider store the test results. But with the lack of a coding system to identify unique tests, it becomes difficult to compare results across similar assays. (Another blog post discusses a solution for this problem.) Clear report designs are important and should also be understood by the patient and non-specialists.

A second issue is the absence of a standardized approach for interpreting test data for clinical decision-making. EHR systems have developed clinical interpretations based on only a few reported variants. However, third-party vendors offer more comprehensive interpretation tools. But this critical step should become far more integrated and intuitive for the clinician.

12. Limited infrastructure for data integration

There is a lack of infrastructure in place to support the integration of genomic data into standard patient care, including system interoperability through the adoption of available data standards. Health information networks (HIN) and health information exchanges (HIE) exist. But just like the Integrating the Healthcare Enterprise (IHE) initiative, genomics is currently not on their list of supported clinical domains.

As mentioned previously with issue #10, genomic repositories, when built, need to be interoperable with EHR systems. But upstream of that, labs need to send the sequencing data directly to the GACS. To facilitate this, HL7 FHIR Genomics Reporting and the Global Alliance for Genomics and Health (GA4GH) standards need to be adopted. To promote this, the GenomeX FHIR accelerator program seeks to collaboratively design interfaces enabling genomic data to be transmitted from laboratories to EHRs and/or genomic repositories, and also make possible access to genomic data through APIs to develop a range of genomic applications. (Future blog posts will cover HL7, GA4GH, and GenomeX.)

13. **Patient informed decision making, consent, and access**

Patients should be informed about the risks and benefits of genetic and genomic testing, along with any calculated out-of-pocket costs. As testing can be used to predict future health outcomes for themselves, and may be medically relevant information for family members, patients need to be aware of possible unforeseen results. The issue of "incidental findings" should be reviewed. Incidental findings are results that were not expected or were not the primary focus of the test but were nonetheless discovered during the course of the test. These findings may have clinical significance and may require further investigation or follow-up.

Some people may not want their physician accessing their genome when it is not medically necessary, or they may feel that it would breach their privacy. Towards that end, I propose that a patient testing and data sharing consent application be developed. This would allow the patient to manage consent-required healthcare delivery situations, along with directing data access to healthcare providers and themselves. A smart strategy would be to support patient access to and ownership of their multiomic profile data. I know this is going against the current business model, but it is the future. Recent legislation and regulations have already started the industry down this path.

14. Regulatory/accreditation barriers and ethical concerns

Regulatory issues can easily become barriers. The list includes: 1) FDA regulation of genetic tests add extra time and expense to the development and marketing of new genetic tests; 2) the Clinical Laboratory Improvement Amendments (CLIA) certification requires laboratories that perform genetic testing to be certified by the government, which is definitely costly and time-consuming; 3) the Health Insurance Portability and Accountability Act (HIPAA) regulates the handling of patient health information, including genetic data; 4) the Genetic Information Nondiscrimination Act (GINA) is a U.S. federal law that prohibits discrimination on the basis of genetic information in health insurance and employment, and 5) different countries have different regulations for genetic testing, which can make it difficult for companies to market and sell their clinical genomic services internationally.

There are ethical issues surrounding predictive testing, which can lead to anxiety and uncertainty, particularly if the test results are uncertain or inconclusive. Ethical issues also include the differences in utilization of clinical genomic services between cultures and populations, where language and traditions play a big role. Genetic testing for children raises ethical issues about autonomy, decision-making, and long-term implications for the child and their family. And finally, ethical concerns may include using patient-generated data and data from direct-to-consumer services.

15. Limited business drivers and investment by health care systems

One could argue that this issue could be like a quantum particle, simultaneously both first and last on the list. And one could also argue that this barrier is self-imposed.

Health care systems claim they are all about precision medicine and how they will use it to improve patient outcomes, reduce costs, and provide more accurate and precise diagnosis and treatment options. But enterprise budgets do not show clinical genomics as a high business priority.

Clinical genomics, if properly designed and implemented, can generate new revenue streams and provide the organization with a competitive advantage. Health delivery systems that have a clinical genomics program are seen as more advanced and innovative, which can attract more patients and increase market share. With such programs operational, they could then support research initiatives, such as identifying new biomarkers for diseases and developing new therapies. Yet most system websites do not even list a full menu of clinical genomic services. But when all this is in place, clinical genomics will become the standard of care.

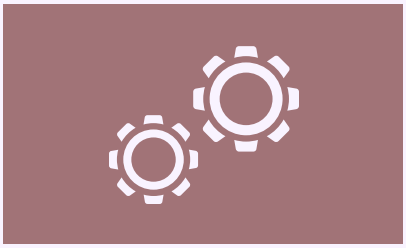
The Call to Action

⇒ Healthcare systems should have clear communications on the genetic services they provide.
⇒ Medical specialty associations should drive requirements so that EHR systems support the computability of their genetic-based guidelines.
⇒ Insurance companies should state their coverage policies for each genetic test ordered by a clinician.
⇒ Tech products should clearly show their genomic capabilities and advance their integration of genomic data.

We really want to see these actions happen. Your input and ideas will determine the next steps and development of each action strategy. Progress will be tracked in future posts. This blog is not designed for passive readers. If you agree with these actions, let's work together to make it happen. We will pursue these and future Call-to-Actions over time until we can verify that they have been achieved. Stay tuned!

Connection

To join this Call-to-Action, email ideas, efforts, and results to moveforward@genomics.network

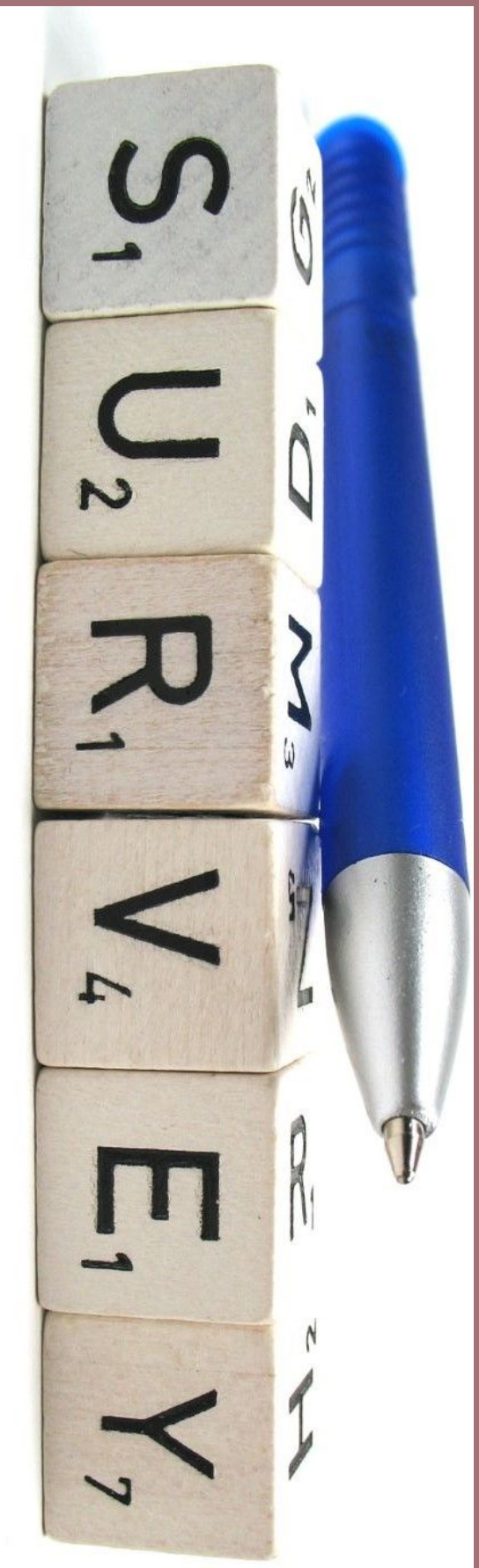


The Survey

Business issues survey – your input

To gather further insights into some of the business issues you may be facing, we have developed a quick two-minute survey. The questions present a business issue, and ask you to rank the problem level of that issue from 1 to 5. A survey report reviewing the responses will be posted when a significant number of responses are received. This will generate further ideas for your feedback and our discussion. It will also provide data for future posts on building a genomics program, an ecosystem, and other post topics. No sign-in is required, and no emails will be collected.

2-minute survey



Genetic care coordination for the patient lifespan

Final thought - Genomics standard of care from the view of the patient lifespan

The lifecycle of genomic data differs from that of other types of information typically documented and collected in healthcare. Although the human genome remains constant throughout a patient's life, sequencing techniques do not. Data may need to be completely reevaluated in the future as methods are refined for more robust clinical validity and reliability. Clinical sequencing laboratory tests use a reference value to measure parameters and produce an interpretation with clinical context. If our understanding of a disease, or its causes and indicators, changes, reinterpreting longitudinal data and reassessing a patient's health can be relatively simple with the right technology in place.

Given that relevant information may be passed down for several generations and apply to multiple patients, additional thought must be given to longitudinal data reinterpretation and how genomic data from one individual can be made available to subsequent generations of family members. This challenge raises bioethical concerns about risk notification and communication, but smart people are researching and developing the best practices for data use over a patient's lifespan.

Conclusion

It is still an open question when clinical genomics will become the standard of care for patients. While genomics has the potential to revolutionize healthcare, there remain several issues and barriers that are slowing its adoption, not just in one clinic, but in all the clinics and services throughout the enterprise. To overcome these barriers, there needs to be a concerted effort by all stakeholders to address the clinical, business, technology, and governance issues. This list of 15 did not cover every detail of this multidimensional initiative but highlighted the major issues to be considered.

The momentum behind clinical genomics will continue to grow over time. Patients, clinicians, payers, and regulators alike have all expressed interest in overcoming the barriers to a successful implementation. There are many opportunities on the horizon for making clinical genomic information more accessible than ever before, whether it be through apps on smartphones or other mobile devices. The application of artificial intelligence will further complicate this activity but will also take clinical genomics to new levels. This field is always evolving with new knowledge to further advance patient care. Each day brings more business value and clinical necessity for the lifespan of ourselves and our families.