PMC PERSONALIZED MEDICINE COALITION

PERSONALIZED MEDICINE IN BRIEF

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PRESIDENT'S BRIEF

Turning a Corner

by Edward Abrahams, Ph.D., PMC President

Following the approval this summer of the first cancer drug that references only specific biomarkers rather than the tissue of origin and the recommendation by a scientific advisory committee to FDA that the agency approve the first gene therapy, a novel treatment for leukemia that uses the patient's own re-engineered cells to fight the disease, personalized medicine is turning a corner.

Cynthia Bens testifies before Congress on the purpose and design of the Prescription Drug User Fee Act VI. Cynthia, a long-time champion for personalized medicine, has joined the PMC team as Vice President, Public Policy.

While these milestones in the history of medicine are significant, they also illustrate the importance of PMC's mission — to pave the way for investment in and adoption of new discoveries and technologies that make personalized medicine possible, now more important than ever.

The field continues to challenge our conceptions of what works best for patients and the health care system. The advent of innovative targeted therapies with unprecedented medical value, for example, has heightened concerns over access, and sometimes those concerns even overshadow the enthusiasm for continued scientific progress. Most developers of value assessment frameworks, meanwhile, remain focused on population averages despite exhortations that they consider heterogeneity. And the Trump administration's proposal to cut funding for biomedical research at the National Institutes of Health by 18 percent threatens the foundational efforts upon which continued progress in personalized medicine depends.

Still, medical centers across the United States have begun integrating personalized medicine in the clinic, and a groundbreaking agreement between Amgen and Harvard Pilgrim Health Care anticipates an era in which industry and payers share in the financial risks of prescribing therapies that promise to deliver value in part by delivering downstream benefits for patients and the health system.

To meet the opportunities and challenges we face in this new era, PMC has hired a new Vice President for Public Policy. She is Cynthia Bens, who for over a decade has directed policy initiatives at the Alliance for Aging Research, becoming one of the foremost proponents for patients in

"While these milestones in the history of medicine are significant, they also illustrate the importance of PMC's mission — to pave the way for investment in and adoption of new discoveries and technologies that make personalized medicine possible."

Washington, D.C. She will greatly expand PMC's capacity to make our voices heard by the United States Congress and by the agencies that shape regulatory and reimbursement policy. Together with Daryl Pritchard, Ph.D., who will continue to lead the Coalition's science policy efforts, PMC is well positioned to educate the new Congress and administration about the power and importance of personalized medicine to address areas of concern to policymakers, notably its ability to both improve clinical care and increase efficiency in the health system.

This, in fact, will be a central theme of PMC's 13th Annual Personalized Medicine Conference at Harvard Medical School in Boston, scheduled for November 14 - 16. The conference will cover all of the issues facing personalized medicine today, including CRISPR, gene editing and gene therapy, pharmaceutical pricing, and the use of real-world evidence to improve care. The conference will also emphasize PMC's efforts to highlight personalized medicine's value proposition. We will showcase, in particular, our work on value frameworks and personalized medicine, the clinical and economic value of next-generation sequencing, and the development of clinical adoption strategies in different institutions across the United States.

ISSUE BRIEF

Drug Pricing Dialogue Still Looms Over Landscape for Innovation in Personalized Medicine

by Christopher Wells, PMC Communications Director

In 2012, a breakthrough personalized medicine called Kalydeco® (ivacaftor) shined a national spotlight on the value of innovation by becoming the first FDA-approved drug to treat the underlying genetic cause of cystic fibrosis, rather than the symptoms. Experts praised Kalydeco as a "wonder drug," and in the years that followed patients raved about its clinical value.

"I would do anything to get Kalydeco — pay any price," explained Rebecca Schroeder, whose son Brady benefited from Kalydeco. "Watching your child struggle to breath and slowly suffocate on their own mucous is an indescribable type of torture. Kalydeco took that away."

But the enthusiasm for the drug, which comes at a list price of over $300,000, soon collided with access concerns. As clinicians, insurance companies and lawmakers began to scrutinize list prices for innovative new drugs with renewed vigor, advocates worried that patients would be stuck with the bill.

"We want to be sure that when these drugs come to market, they aren't priced at a level people can't afford," National Coalition on Health Care President John Rother explained to *The Washington Post* in 2015. "That's not the kind of world we want to live in."

These concerns helped fuel a passionate attack on the pharmaceutical industry's pricing practices that brought the iShares NASDAQ Biotechnology Index, which tracks the performance of biotechnology stocks, down by nearly 22 percent in 2016. The dialogue even colored campaigns for the U.S. Presidency, with the eventual winner famously accusing the industry of "getting away with murder."

Biotechnology stocks dropped by nearly 22 percent in 2016 amid criticisms of the pharmaceutical industry's drug pricing practices. Although they have partially rebounded in 2017, the drug pricing dialogue still looms over the landscape for innovation in personalized medicine. *Image credit: CNBC*

That conversation — which remains focused almost exclusively on list prices — still looms over the landscape for innovation in personalized medicine.

Although Congress has been slow to embrace proposals that would allow Medicare to negotiate the price of drugs or legalize the importation of drugs from Canada, the pharmaceutical industry's own solutions have done little to appease those who believe dramatic policy changes are warranted. These solutions include so-called "risk-sharing" agreements in which pharmaceutical companies agree to reimburse insurance companies for the cost of drugs that do not yield the anticipated results. Peter B. Bach, M.D.,

"Although Congress has been slow to embrace proposals that would allow Medicare to negotiate the price of drugs or legalize the importation of drugs from Canada, the pharmaceutical industry's own solutions have done little to appease those who believe dramatic policy changes are warranted."

Director, Center for Health Policy and Outcomes, Memorial Sloan Kettering Cancer Center, says these arrangements are often nothing more than "bells and whistles."

"As long as you control all the contract terms, it can be a lot of optics but no substance," Bach said.

In July, the Trump administration offered its own compromise, in the form of an executive order that would ease regulatory hurdles that add to the drug industry's research and development costs, which must be recouped in part by sales. This, too, was met with skepticism.

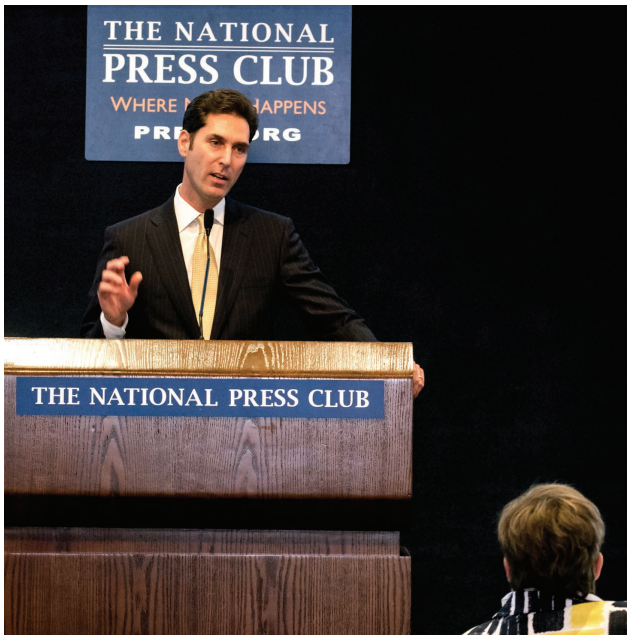
"I do believe that the President wants to do something to lower drug prices for people, but this is a far cry from what he said on the campaign trail," said David Mitchell, President, Founder, Patients for Affordable Drugs. "I don't see anything there that addresses the drug companies 'getting away with murder.'"

PhRMA emphasizes that list prices do not correspond with what patients pay. Policies that focus on reducing list prices, the trade association warns, could disrupt innovative research for the 6,300 medicines in development globally — 42 percent of which are personalized medicines that may help mitigate rising health care costs by eliminating systemic inefficiencies associated with the standard treatment of patients that do not benefit from, yet often still receive, existing treatment options. Confident in the value of innovative medicines to the health system overall, the organization advocates for reimbursement reforms that pay doctors and hospitals based on their patients' health outcomes, rather than the volume of services provided. President and CEO Stephen J. Ubl is preparing to discuss the cost of personalized medicines, which must recoup research and development costs from smaller patient populations, at the 13th Annual Personalized Medicine Conference at Harvard Medical School in November.

"Unfortunately, a lot of the [rhetoric] is born of the mistaken view that drug prices are fueling overall cost growth," Ubl explains. "We're trying to educate policymakers on both the marketplace dynamic, which I think is misunderstood, as well as the value the products bring to patient care and health care systems."

Ubl will deliver his remarks on prices for personalized medicines at 2:15 p.m. ET on November 15, during a fireside chat with CNBC Reporter Meg Tirrell.

Stephen J. Ubl, President, CEO, PhRMA, who is pictured here at PMC's 12th Annual State of Personalized Medicine Luncheon in 2016, will share his thoughts on the cost of personalized medicines at the 13th Annual Personalized Medicine Conference.



NEWS BRIEF

FDA Embraces Personalized Medicine With Series of Landmark Decisions

by Christopher Wells, PMC Communications Director

Since the approval of the first genetically targeted cancer drug, oncologists in the U.S. who wanted to consider prescribing these treatments have faced an unenviable choice between two options that often take weeks: They could assess the patient's candidacy for one drug at a time through separate FDA-approved companion diagnostics, or they could order a laboratory test that is not FDA approved and probably not covered under the patient's insurance plan. In both cases, the patient's disease can wreak havoc before the results are returned.

FDA Commissioner Scott Gottlieb, M.D., has already overseen two regulatory precedents in personalized medicine. He says the agency is working on a new plan to accelerate medical innovation by streamlining the approval of targeted therapies and other novel drugs, and is preparing to deliver remarks at the 13th Annual Personalized Medicine Conference in November.

Now there is another option.

In the latest of a series of regulatory precedents for personalized medicine, FDA approved Thermo Fisher's Oncomine Dx Target Test on June 22 to guide treatment for three genetically targeted drugs at once — and return the results in a matter of days.

The approval, experts say, represents a long-awaited turning point for personalized medicine, anticipating an era in which doctors can quickly understand which treatments will work best for each patient by using so-called "universal" diagnostics.

But for FDA in 2017, it was just another day at the office.

The agency's flurry of activity around personalized medicine began on April 6, just shy of a month before Scott Gottlieb, M.D., was sworn in as FDA Commissioner. On that day, FDA gave 23andMe permission to market 10 direct-to-consumer tests for genetic risk factors — a first-of-its-kind decision that has opened the door to a new era in consumer genomics.

A little more than a month later on May 23, Gottlieb oversaw the agency's approval of Merck's Keytruda® (pembrolizumab) for the treatment of tumors that express one of two biomarkers regardless of where in the body the tumors are located. That decision marked the first time FDA has approved a cancer drug for an indication based on the expression of specific biomarkers rather than the tumor's location in the body.

There is reason to believe that these announcements are more than the sum of their parts. In a Congressional testimony on June 21, Gottlieb told lawmakers that the agency

"There is reason to believe that these approvals are more than the sum of their parts."

is working on a new plan to accelerate medical innovation by streamlining the approval of targeted therapies and other novel drugs. These treatments, he said, have the potential to help drive down health care costs. Gottlieb plans to outline the agency's commitment to innovation in personalized medicine during a keynote address at the 13th Annual Personalized Medicine Conference.

"The most tangible way we're going to reduce health care costs is by finding better treatments for a lot of costly diseases," he explained during the testimony.

Less than a month after the testimony, Janet Woodcock, M.D., Director, Center for Drug Evaluation and Research, FDA, underlined the agency's commitment to personalized medicine in a blog titled "Two Recent Scientific Advances Underscore an Encouraging Future for Precision Medicine at FDA." FDA, she wrote, is "actively pursuing more advances in targeted therapies." She cited the new approval for Keytruda and a new indication for Vertex's Kalydeco® (ivacaftor) as a treatment for cystic fibrosis patients with one of 23 additional rare mutations as evidence of the agency's support for the field.

"We believe it is important to make drugs such as Kalydeco and Keytruda available to as many patients as can benefit from them," she wrote in the blog, which was published on July 11.

Encouraged by the agency's progress, PMC President Edward Abrahams, Ph.D., said these developments warrant a renewed focus on the part of lawmakers to overcome outstanding challenges in research, regulation and reimbursement.

"Confronted with unprecedented opportunities in personalized medicine, policymakers would do well to ensure that our research, regulatory, and reimbursement systems facilitate the development of and access to these promising new therapies," he wrote in an op-ed published by *STAT News* on June 21.

NEWS BRIEF

‘Risk-Sharing’ Agreement Emerges as Potential Model for Securing Coverage of Promising Personalized Medicines

by Christopher Wells, PMC Communications Director

For as long as the concept of personalized medicine has existed, industry has had difficulty securing payment for diagnostics and sometimes therapies that promise to deliver value in part by helping patients avoid downstream medical costs associated with ineffective treatments. A new approach spearheaded by Amgen and Harvard Pilgrim Health Care, however, may become a model for overcoming that challenge.

In the groundbreaking agreement with Harvard Pilgrim, Amgen has agreed to absorb the cost of its treatment for hypercholesterolemia, Repatha® (evolocumab), for patients covered by Harvard Pilgrim who suffer a heart attack or stroke while taking the drug. Michael Sherman, M.D., Senior Vice President, Chief Medical Officer, Harvard Pilgrim Health Care, who is also a PMC Board member, said the so-called “risk-sharing” agreement reflects Amgen’s confidence in the value of Repatha, which is priced at $14,000 per year.

“That Amgen is willing to go at financial risk for patients with elevated LDL-C levels who are adherent to Repatha and suffer cardiovascular events shows that they are willing to stand by their data, and that sends a strong positive message to health plans, prescribing physicians and patients,” Sherman said in a statement.

Joshua J. Ofman, M.D., Senior Vice President of Global Value, Access and Policy, Amgen (left), and Michael Sherman, M.D., Senior Vice President, Chief Medical Officer, Harvard Pilgrim Health Care, believe the companies’ new risk-sharing reimbursement agreement represents a powerful tool for facilitating patient access to personalized medicine. Ofman and Sherman will discuss the agreement at the 13th Annual Personalized Medicine Conference in November.

Amgen’s confidence in Repatha may be due in part to a personalized drug development strategy rooted in an understanding of expressed biomarkers and the unique circumstances surrounding each patient’s diagnosis. Unlike many other hypercholesterolemia drug developers, Amgen sought approval for Repatha, which inhibits a protein called PCSK9 that is known to disrupt the liver’s ability to remove LDL cholesterol from the bloodstream, for only the subset of hypercholesterolemia patients who have been diagnosed with familial hypercholesterolemia or clinical atherosclerotic cardiovascular disease. Patients with familial hypercholesterolemia are diagnosed based on a family history

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>
> Michael Sherman, M.D., Senior Vice President, Chief Medical Officer, Harvard Pilgrim Health Care

of hypercholesterolemia and/or the results of specific DNA tests — including those that assess the PCSK9 mutations targeted by Repatha. As a result, Repatha may be especially effective in patients with that disease.

"Amgen is committed to combating cardiovascular disease, one of the largest public health concerns in the world, and our value-based partnership with Harvard Pilgrim further demonstrates our confidence in the significant value that Repatha can bring to patients, payers and society," Joshua J. Ofman, M.D., Senior Vice President of Global Value, Access and Policy, Amgen, said in a statement. "Given the urgency to reduce LDL cholesterol in patients at high risk of cardiovascular events, we value our relationship with leading health plans like Harvard Pilgrim, who have worked with us to refine their utilization management criteria to accelerate access for their high-risk patients."

Ofman and Sherman will discuss the significance of the new agreement on the first day of the 13th Annual Personalized Medicine Conference at Harvard Medical School in November.

SCIENCE POLICY BRIEF

PMC Charts Course for Personalized Medicine in Value Assessment

by Daryl Pritchard, Ph.D., PMC Vice President, Science Policy

In purpose, personalized medicine and value assessment frameworks (VAFs) are clearly aligned. Both seek to increase the efficiency of health care systems.

But despite their shared objectives, most VAFs have not been designed with personalized medicine in mind. They are instead focused on population health, not accounting for heterogeneity of treatment effects. In many cases, VAFs do not sufficiently acknowledge the value of tools like diagnostic testing, genetic counseling, and a patient's values and circumstances.

For example, the Institute for Clinical and Economic Review (ICER)'s recent evaluation of treatment options for advanced non-small cell lung cancer did not fully account for the role that diagnostics play in treatment decision-making. The report was critiqued by the American Lung Association for "taking the precision out of precision medicine" and by the Cancer Support Community for a "lack of consideration of the patient definition of value."

Likewise, the ICER evaluation for relapsed or refractory multiple myeloma was criticized for lacking satisfactory reflection of the patient perspective and engagement with the patient community, prompting the National Health Council to issue a formal call to appropriately and consistently include the patient perspective as a central component in value assessments.

To help move these communities toward a shared definition of value, PMC has developed a white paper that examines how personalized medicine has been, and should be, considered in value assessments. The report will inform the discussion on how VAFs can incorporate personalized medicine to better address treatment value, and will also provide a contrasting breakdown of how VAFs, without appropriately considering personalized medicine, could undermine quality health care.

The report identifies several necessary considerations related to personalized medicine in VAFs:

- **Heterogeneity of treatment effects** — Most VAFs estimate the value of a treatment or regimen utilizing a population average benefit, which does not, by design, account for individual variation in response, tolerability and outcomes.
- **Diagnostic testing** — Understanding individual patient biomarkers, in many cases, can allow for earlier, more accurate diagnoses and targeted therapy that provides safer and more effective treatment options.
- **Individual patient values and circumstances** — Patients, in consultation with their doctors, consider several factors that impact the value of a treatment to the patient, including the impact of treatment on quality of life, time and functional ability related to illness or treatments, cost of supportive care, and other patient costs.
- **Treatment efficiency** — A targeted treatment plan can often improve patient outcomes and bring down costs in the long-term by helping to avoid ineffective treatment options and reducing the downstream expenses associated with rapid disease progression.
- **Reduced adverse events** — Targeted treatment plans can also improve patient safety and bring down costs in the long-term by helping to avoid or reduce harmful treatment options and reducing the downstream expenses associated with adverse events.
- **Emerging and evolving value elements** — Personalized medicine involves novel innovative technologies whose impact on health outcomes, costs and downstream technological advancement cannot be fully understood at the time of launch.

As VAFs evolve, incorporation of these personalized medicine considerations will allow them to be more sophisticated and useful for delineating the value of treatments to both the patient and the health care system.

"Most value assessment frameworks have not been designed with personalized medicine in mind."

NEWS BRIEF

Scientific Approval of First Gene Therapy Anticipates Era of 'Living Drug'

by Christopher Wells, PMC Communications Director

In a commentary published by *Nature Biotechnology* in June, a team of authors led by Huub Schellekens, M.D., a professor of pharmaceutical biotechnology at Utrecht University in the Netherlands, points out that "precision medicine today is not tailored to individual patients; it is tailored to groups of patients."

That is expected to change by October.

That expectation is rooted in the pending regulatory approval of Novartis AG's CTL-019, a first-in-class treatment that involves the re-engineering of a patient's own immune cells to treat leukemia. On the back of an 83 percent remission rate in clinical trials, FDA's scientific advisory panel on July 11 recommended approval of CTL-019 for children and young adults whose disease does not respond to standard therapies. The agency is expected to formally approve CTL-019 by the end of September, making it the first gene therapy available for clinical use in the U.S. — and possibly marking the start of a new era in oncology.

"This is a potentially paradigm-changing type of benefit," said Brian Rini, M.D., a physician at Cleveland Clinic's Taussig Cancer Institute who reviewed CTL-019 as part of the advisory committee.

Known as a chimeric antigen receptor T cell (or CAR-T) therapy, the one-time treatment requires the extraction of so-called "T cells" from a patient's blood, which are then frozen and sent to Novartis' plant in Morris Plains, N.J. There, scientists use a weakened fragment of HIV to modify the T cells' genes, equipping them with the ability to identify and destroy cells that express the CD19 protein, which is linked to the development of cancerous white blood cells that cause leukemia. Novartis completes the 22-day process — which analysts say will likely cost between $300,000 and $600,000 — by shipping the cells back to the hospital, where the immuno-army is injected into the patient. The modified T cells continue to reproduce in the body while combatting the disease.

Carl June, M.D., who conceptualized the therapy in his laboratory at the University of Pennsylvania, calls CTL-019 "a true living drug."

"[CTL-019] is the most exciting thing I've seen in my lifetime," added Timothy Cripe, M.D., Ph.D., an oncologist at Nationwide Children's Hospital in Columbus, Ohio.

The treatment is not perfect. In their most severe form, the side effects of CTL-019 can include cytokine release syndrome, an immune-system reaction that can be fatal. CTL-019 can also cause temporary confusion and brain swelling.

These complications, however, are typically manageable under the appropriate treatment protocol. Novartis has proactively committed to a staggered rollout plan to ensure the treatment is only administered by physicians with the required expertise.

"I don't think any of these considerations would be showstoppers for the outstanding clinical results," said Larry Kwak, M.D., Ph.D., a hematologist and oncologist with City of Hope, a cancer treatment center located in Duarte, CA.

CAR-T therapies are also in development at Kite Pharma and Juno Therapeutics. FDA is expected to decide on Kite's CAR-T treatment by November 29. In the meantime, the companies are celebrating the advancement of the CAR-T concept.

"I will be Novartis' biggest cheerleader today," Kite CEO Arie Belldegrun, M.D., wrote in a blog posted after the approval.

The 'Living Drug'

"This is a potentially paradigm-changing type of benefit."
Brian Rini, M.D., Taussig Cancer Institute, Cleveland Clinic

"[CTL-019] is the most exciting thing I've seen in my lifetime."
Timothy Cripe, M.D., Ph.D., Nationwide Children's Hospital

"I will be Novartis' biggest cheerleader today."
Arie Belldegrun, M.D., Kite Pharma

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Pricing Personalized Medicines

with Stephen J. Ubl, President, CEO, PhRMA

"Unfortunately, a lot of the [rhetoric] is born of the mistaken view that drug prices are fueling overall cost growth." (see page 4)

Personalized Medicine at FDA: An Inside Look at the Agency's Priorities for the Field

with Scott Gottlieb, M.D., Commissioner, FDA

"The most tangible way we're going to reduce health care costs is by finding better treatments for a lot of costly diseases." (see page 6)

Progress in Partnerships: A Model for Risk-Sharing Agreements Between Payers and the Pharmaceutical Industry

with Michael S. Sherman, M.D., M.B.A., M.S., Senior Vice President, Chief Medical Officer, Harvard Pilgrim Health Care

"[This agreement] sends a strong positive message to health plans, prescribing physicians and patients." (see page 8)

World-class industry professionals, policy experts, clinicians, payers and patient advocates convene at the Annual Personalized Medicine Conference to define and examine the science, business and policy issues facing the field. Their conclusions, which PMC publishes in its annual *Conference Summary*, help shape the community's agenda and guide the Personalized Medicine Coalition's work.

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INSIGHTS IN BRIEF

Pioneering Precision: Lessons Learned From Clinical Adoption Efforts at Sylvester Comprehensive Cancer Center

by Bat-ami Katzman Gordon, Project Manager, Sylvester Comprehensive Cancer Center, University of Miami, and Avantika Handa, M.H.A., C.S.S.G.B., Senior Project Manager, Operations, Sylvester Comprehensive Cancer Center, University of Miami

The rise and expansion of next-generation sequencing (NGS) in clinical oncology has created unique challenges for academic medical centers (AMCs), largely because the existing infrastructure at AMCs was not designed to handle the volume or types of data generated by NGS testing. As a result, AMCs have retroactively built solutions to manage the end-to-end process of advanced molecular testing. While developing infrastructure and processes to manage molecular testing and data, institutions also need to anticipate future demand for newer -omics technologies.

While developing the precision medicine program at the University of Miami's Sylvester Comprehensive Cancer Center (SCCC), we identified key components necessary to build a scalable precision medicine program: Interdepartmental operations, IT infrastructure, clinical integration and data management.

Operations

The lifecycle of NGS testing — from test ordering to result interpretation — is a complex process at risk for long turnaround times. In academic settings, multiple departments must coordinate efforts to provide end-to-end NGS testing capabilities to clinicians. At AMCs, physicians are often waiting on the results of NGS testing to determine the next step in a patient treatment plan, including clinical trial availability.

Thus, streamlined workflows for ordering and tissue specimen handling are required to avoid treatment delays. SCCC established a multi-disciplinary team to develop a collaborative workflow between departments. The team mapped out the workflow, defined acceptable turnaround times, identified delays in the process and developed interventions to improve the timely delivery of results. Workflow considerations included the pathology department's policies regarding releasing tissue samples and the NGS testing facility's need to balance batching samples for cost-effectiveness and expediency in turnaround time.

IT Infrastructure

The most important IT infrastructure components for advanced molecular testing are electronic ordering and electronic result delivery within the electronic medical record (EMR). Physicians initially placed paper orders for tests and received results via fax. To improve efficiency, SCCC created electronic orders for NGS testing in the institute's EMR. SCCC also implemented a cloud-based software to process orders and map results from all testing vendors to a specific location in the EMR. Finally, electronic orders allowed institutions to bill payers for these tests, consistently document medical necessity, track quality control metrics and collect aggregate data.

Clinical Integration

The increased availability of molecular "basket" trials like the National Cancer Institute's Molecular Analysis for Therapy Choice (MATCH) trial and the American Society of Clinical Oncology's Targeted Agent and Profiling Utilization Registry (TAPUR) trial, coupled with the biomarker-based approval of targeted therapies like Keytruda, obliges AMCs also to continue integrating precision medicine in the clinic.

SCCC has implemented a weekly and monthly molecular tumor board (MTB) to review cases in order to advance clinical integration. The MTB generates patient-focused clinical recommendations based on the results of NGS in the context

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of detailed patient histories, performance statuses, ability to travel, prior therapies, disease sites, clinical trial eligibility and other factors that may guide clinical trial or targeted therapy options. The monthly MTB utilizes multidisciplinary expertise across the University of Miami, including clinicians, pathologists, pharmacists and research scientists. The MTB serves as a forum for physicians to discuss their complex cases and experiences with targeted therapies and clinical trials. Given the rapidly evolving nature of this field, forums like MTBs are necessary to bridge the gap between clinical practice and evolving science.

Data Management

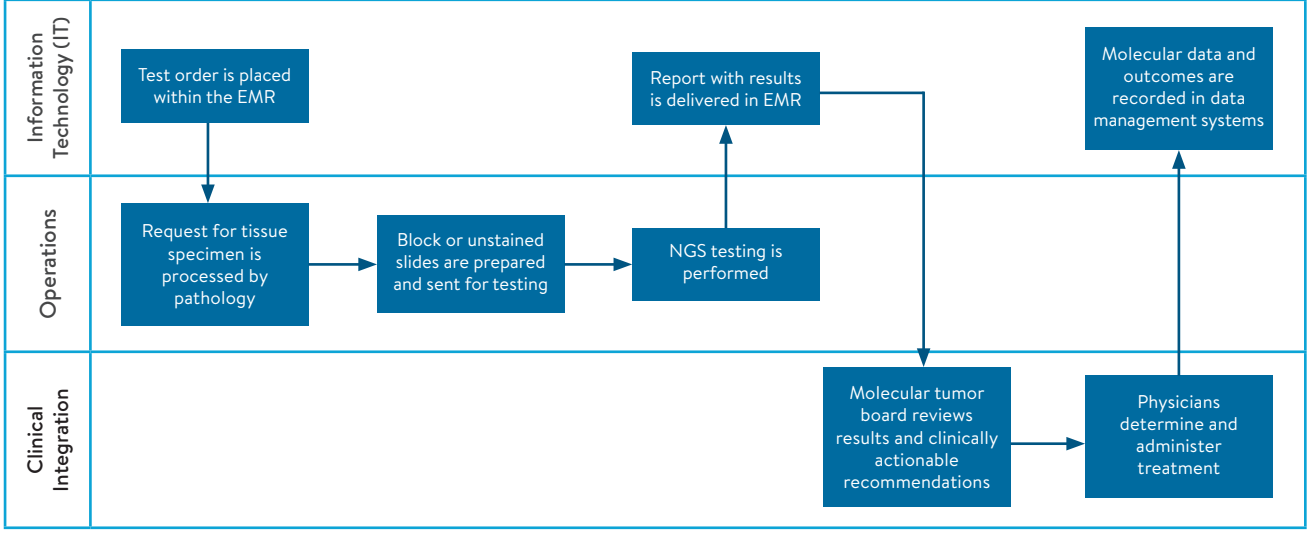
There is consensus in the industry that structured molecular data is instrumental for advances in precision medicine, yet capturing this data is a challenge. Advanced IT infrastructure is required to manage and utilize large volumes of data. The aforementioned cloud-based data solution connects molecular laboratories and the EMR. This solution aggregates genomic information as discrete data, facilitating research into our patient population and outcomes of molecularly driven therapies. This functionality will promote research across the institution and collaborations with other cancer centers.

Conclusion

As AMCs work to meet the demands of current testing, institutions must proactively build infrastructure and processes that are scalable and adaptable to account for newer -omics technologies. Future work will also focus on the collection and mining of data, as AMCs are uniquely positioned to demonstrate evidence of the clinical utility and effectiveness of NGS testing and build the case for payer reimbursement for advanced molecular testing.

End-to-end Molecular Testing

End-to-end molecular testing requires cooperation between IT, operations and clinical teams.



PMC NEWS BRIEF

PMC Encourages Congress to Support Personalized Medicine With NIH Budget Boost, Clinical Utility Research, Thoughtful Consideration of Landscape for LDT Oversight

by Christopher Wells, PMC Communications Director

In a series of communications designed to help facilitate a more favorable policy environment for the development of personalized medicine products and services, PMC recently encouraged Congress to increase the National Institutes of Health (NIH)'s budget by $2 billion, advance a bill that would direct the National Academy of Medicine (NAM) to publish a study on the clinical utility of genetic tests and ensure that any changes to the landscape for oversight of laboratory-developed tests (LDTs) reflect a series of principles that the personalized medicine community agrees are necessary for sustaining progress.

The Coalition published its resolution calling for a budget increase at NIH after U.S. President Donald Trump followed his calls for cuts to NIH's budget in 2017 with a similar proposal to reduce the agency's funding by 18 percent in 2018. A reduction of that magnitude, PMC President Edward Abrahams told *The Boston Globe*, would undermine Congress' initiatives to support innovation in personalized medicine. Those initiatives include a bipartisan effort by Reps. Larry Bucshon (R-IN) and Diana DeGette (D-CO) to establish a new framework for oversight of LDTs and a bill from Rep. Eric Swalwell (D-CA) that would provide for a study at NAM to evaluate the clinical utility of genetic tests.

"The President's ongoing desire to cut NIH's research budget contradicts the bipartisan support [for innovative biomedical research]," Abrahams said. "It would be a travesty for patients and the future of personalized medicine if enacted."

After voicing its support for Swalwell's "Access to Precision Medicine Advancement Act" in a comment letter in July, PMC also sent a letter to Reps. Bucshon and DeGette noting that although the Coalition does not hold a position on whether oversight of LDTs should be handled by FDA or the Centers for Medicare & Medicaid Services (CMS), the Coalition has identified principles in this area that would encourage the advancement of personalized medicine. These principles, PMC indicated, should be top of mind as lawmakers refine the bill.

"Comprehensive statutory reform that incorporates the principles PMC has articulated — and reflects the concerns of all stakeholders — would go a long way toward encouraging investment and innovation in personalized medicine," Abrahams told *GenomeWeb*.

> "We appreciate that your draft legislation directs the National Academy of Medicine to study the use of genetic and genomic testing to improve health care outcomes, and support in particular the provision addressing the need to develop evidence for clinical utility and appropriate use of [these] tests."
>
> PMC in comment letter to Rep. Eric Swalwell (D-CA)

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MEDIA BRIEF

From the PMC News Desk

Precision Oncology Trend Report Emphasizes Ongoing Need for Evidence of Field's Benefits to Patients, Health System

In the third edition of its *Precision Oncology Annual Trend Report*, Novartis emphasized the ongoing need for evidence in support of personalized medicine's benefits for patients and the health system. Reimbursement for personalized medicine, the report notes, is tied to that evidence.

"Precision medicine has the capacity to revolutionize oncology care, but if payers are unwilling to provide coverage for genomic testing, this important progress will be stalled," the report states.

Precision Oncology Annual Trend Report: Third Edition (August 2017)

Novartis' CTL-019 Becomes First Gene Therapy to Earn Endorsement by FDA's Scientific Advisory Panel

In an endorsement that defines a new paradigm for treating cancer, FDA's scientific advisory panel recommended in July that the agency approve Novartis' CTL-019, a gene therapy, for the treatment of children and young adults whose leukemia does not respond to standard therapies. Clinical experts say the first-in-class treatment, which involves the re-engineering of a patient's own immune cells, reflects the tremendous potential of chimeric antigen receptor T cell (or CAR-T) therapies.

The Washington Post (July 2017)

Landmark Diagnostic Approval Sets New Regulatory Precedent for Tools That Assess Multiple Genes at Once

In a landmark decision that anticipates an era in which doctors can quickly understand which treatments will work best for each patient, FDA approved Thermo Fisher Scientific's Oncomine Dx Target Test on June 22 to guide treatment for three genetically targeted drugs at once — and return the results in a matter of days. Oncomine Dx analyzes 23 genes, and Thermo Fisher believes that FDA's approval will enable it to work quickly to expand the test's indications.

"This first iteration of the test is just the beginning since the diagnostic claims of the Dx Target Test may be expanded in the future based on the existing panel," said Joydeep Goswami, Ph.D., President, Clinical Next-Generation Sequencing and Oncology. "Expanding the range of clinically actionable information is part of the company's goal to help our customers advance precision medicine."

GenomeWeb (June 2017)

Milestone Drug Approval Sets New Regulatory Precedent for Treatments Targeting Tumors in Any Part of Body That Express Relevant Biomarkers

In another milestone decision for personalized medicine, FDA approved Merck's Keytruda® (pembrolizumab) in late May for the treatment of tumors that express one of two biomarkers, regardless of where in the body the tumors are located. The decision marks the first time FDA has approved a cancer drug for an indication based on the expression of specific biomarkers, rather than the tumor's location in the body.

"Our understanding of cancer has been morphing from a tissue-specific disease — think lung cancer or breast cancer— to a disease characterized more by specific genes or biomarkers than by location," PMC President Edward Abrahams wrote in an op-ed published by *STAT News*. "[This decision] underscores that transition and further opens the door to personalized medicine."

STAT News (June 2017)

Trump Proposes NIH Funding Cuts That Could Jeopardize Progress in Personalized Medicine

U.S. President Donald Trump cued a chorus of criticism in May with a proposal to cut the National Institutes of Health (NIH)'s research budget by 18 percent. The proposal, advocates say, could have disastrous consequences for progress in personalized medicine, which requires a continued commitment to biomedical research spending.

"[The budget] would be a travesty for patients and the future of personalized medicine if enacted," PMC President Edward Abrahams told *The Boston Globe*.

The Boston Globe (May 2017)

Amgen, Harvard Pilgrim Announce Groundbreaking Risk-Sharing Agreement That Could Serve as Model for Securing Coverage of Promising Personalized Medicines

In an agreement that could become a model for securing coverage of personalized medicines that promise to help patients avoid medical catastrophes, Amgen announced in May that the company has agreed to cover the cost of its personalized medicine for familial hypercholesterolemia, Repatha® (evolocumab), for patients covered by Harvard Pilgrim Health Care who suffer a heart attack or stroke while taking the drug.

"Given the urgency to reduce LDL cholesterol in patients at high risk of cardiovascular events, we value our relationship with leading health plans like Harvard Pilgrim who have worked with us to refine their utilization management criteria to accelerate access for their high-risk patients," said Joshua J. Ofman, M.D., Senior Vice President, Global Value, Access and Policy, Amgen.

FiercePharma (May 2017)

CLINICAL LABORATORY TESTING SERVICES
AlphaGenomix Laboratories
Empire Genomics
Laboratory Corporation of America (LabCorp)
Metabolon, Inc.
Quest Diagnostics
Taliaz Health

DIAGNOSTIC COMPANIES
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Agendia NV
Alacris Theranostics GmbH
Almac Diagnostics
AltheaDX
ASURAGEN, Inc.
BD (Becton Dickinson & Company)
Biological Dynamics, Inc.
Caprion Proteomics
CareDx, Inc.
Caris Life Sciences
Celcuity, LLC
CoFactor Genomics
Exosome Diagnostics
Foundation Medicine, Inc.
GeneCentric Diagnostics
Genomic Health, Inc.
Guardant Health
Human Longevity
Inivata
Interleukin Genetics, Inc.
Invivoscribe Technologies Inc.
Luminex Corporation
Metamark Genetics, Inc.
MolecularMD
NanoString Technologies
NovellusDx
OmniSeq
Personal Genome Diagnostics (PGDx)
QIAGEN, Inc.
Roche Diagnostics Corporation
Siemens Healthcare Diagnostics, Inc.
SomaLogic, Inc.
Veracyte

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AveXis
Ignyta
Neon Therapeutics
Syros Pharmaceuticals
Unum Therapeutics
Zinfandel Pharmaceuticals, Inc.

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American Clinical Laboratory Association (ACLA)
BIO (Biotechnology Innovation Organization)
Biocom
PhRMA

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GeneInsight
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Astellas Pharma Global Development
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Bristol-Myers Squibb
Celgene
Eli Lilly and Company
EMD Serono
Endo Health Solutions
Genentech, Inc.
GlaxoSmithKline, PLC
Johnson & Johnson
Merck & Co.
Novartis
Pfizer, Inc.
Takeda
Teva

PATIENT ADVOCACY GROUPS
Accelerated Cure Project for Multiple Sclerosis
Alliance for Aging Research
Bonnie J. Addario Lung Cancer Foundation
Bulgarian Association for Personalized Medicine
Friends of Cancer Research
Global Liver Institute
International Cancer Advocacy Network ("ICAN")
LUNGevity Foundation
Melanoma Research Alliance Foundation
Multiple Myeloma Research Foundation
National Alliance for Hispanic Health
National Patient Advocate Foundation

PERSONALIZED MEDICINE SERVICE PROVIDERS
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Be the Partner
InformedDNA
Intervention Insights
KEW Group
Massive Bio
Michael J. Bauer, M.D., & Associates, Inc.
MolecularHealth
NantHealth
N-of-One, Inc.
Perthera
Tempus

RESEARCH, EDUCATION & CLINICAL CARE INSTITUTIONS
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American Medical Association (AMA)
Association for Molecular Pathology (AMP)
Baylor Health Care System Precision Medicine Institute
Brigham and Women's Hospital, Genomes2People Research Program
Brown University
Cancer Treatment Centers of America
The Christ Hospital
College of American Pathologists
Coriell Institute for Medical Research
CREATE Health Translational Cancer Centre, Lund University
Duke Center for Research on Personalized Health Care
Essentia Institute of Rural Health
Geisinger
Genome British Columbia
Genome Canada
Génome Québec
Georgetown Lombardi Comprehensive Cancer Center
Harvard Business School
Helmholtz Zentrum München
Indiana Institute of Personalized Medicine
Inova Health System
Instituto de Salud Carlos III
Intermountain Healthcare
International Society of Personalized Medicine
The Jackson Laboratory
Johns Hopkins Individualized Health
King Faisal Specialist Hospital and Research Centre
Manchester University School of Pharmacy
Marshfield Clinic
Mayo Clinic
MD Anderson – Institute for Personalized Cancer Therapy
Mission Health, Fullerton Genetics Center
Moffitt Cancer Center
National Foundation for Cancer Research
National Pharmaceutical Council
North Carolina Biotechnology Center
NorthShore University HealthSystem
Ontario Genomics Institute
Partners HealthCare Personalized Medicine
Poliambulatorio Euganea Medica
Precision Health Initiative at Cedars-Sinai
Precision Medicine Alliance, LLC
Qatar Biobank
The Quebec Network for Personalized Health Care
Raabe College of Pharmacy, Ohio Northern University
Rutgers Cancer Institute of New Jersey
Sanford Imagenetics, Sanford Health
Stanford University School of Medicine
Sutter Health
Sylvester Comprehensive Cancer Center – University of Miami
UC Davis Mouse Biology Program
University of Alabama, Birmingham
University of California, San Francisco (UCSF)
University of Florida
University of Pennsylvania Health System
University of Pittsburgh Medical Center (UPMC)
University of Rochester
University of South Florida Morsani College of Medicine
The University of Texas System
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RESEARCH TOOL COMPANIES
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STRATEGIC PARTNERS
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ConText
ConvergeHEALTH by Deloitte
Credit Suisse
Defined Health
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Genome magazine
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HealthFutures, LLC
Health Advances, LLC
Hogan Lovells LLP
Innovation Horizons
Jared Schwartz, MD, PhD, LLC
Jane Binger, EdD
The Journal of Precision Medicine
Kinapse
L.E.K. Consulting
McDermott Will & Emery
Navigant
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Personalized Medicine in Oncology™
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Quorum Consulting
Slone Partners
Spectrum
Teal Lion, LLC
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Washington Media Group

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Health Catalyst Capital Management, LLC
Kleiner Perkins Caufield & Byers
Third Rock Ventures, LLC

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Human Longevity
Innovation Horizons
Johns Hopkins Individualized Health
Taliaz Health
University of California, San Francisco (UCSF)
Veracyte

MISSION: The Personalized Medicine Coalition (PMC), representing innovators, scientists, patients, providers and payers, promotes the understanding and adoption of personalized medicine concepts, services and products to benefit patients and the health system.

PMC
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