CRITICAL PATH INSTITUTE

Collaboration as the Solution to the 'Predictability Paradox' in Drug Development

Co-authored by C-Path Board of Directors member Milad Alucozai and Colleen E. Clancy of UC Davis, the paper outlines how human-relevant data, advanced modeling, regulatory innovation and precompetitive collaboration can make drug development more predictable and accelerate access to precision therapies.

TUCSON, Ariz., November 18, 2026 — Biomedical science can increasingly design therapies targeting specific genetic mutations, sometimes for a single patient. Yet the systems used to establish their safety and effectiveness remain largely built for treatments intended for large patient populations. This growing disconnect, which the authors term the "Predictability Paradox," is the focus of a new peer-reviewed publication co-authored by Critical Path Institute® (C-Path) Board of Directors member Milad Alucozai, DrPH, MPH, M.Sc., and Colleen E. Clancy, Ph.D., director of the Center for Precision Medicine and Data Sciences at the University of California, Davis.



Milad Alucozai, DrPH



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Published in The Journal of Precision Medicine: Health and Disease, "From pipeline to platform: Reconstructing biomedical evidence for precision medicine" explains why the next major advances in drug development will call for more than discovering better therapies. They will require fundamentally transforming how biomedical evidence is generated, integrated, evaluated and reused. The paper was authored independently of C-Path and reflects the views of its authors.

The authors describe a drug development ecosystem increasingly capable of engineering medicines with molecular precision, but still dependent on evidence-generation approaches developed for an earlier era. For people living with ultra-rare genetic diseases, where conventional randomized clinical trials may be impractical or impossible, this mismatch can prevent promising scientific advances from becoming accessible treatments. And the implications extend beyond rare diseases. As common conditions such as cancer, Alzheimer's disease and autoimmune disorders are increasingly understood through their distinct molecular mechanisms, traditional approaches centered on average treatment effects may fail to capture important differences in individual treatment responses.

"Validation can no longer be a stamp at the end of the pipeline. It has to be a loop, where human data continuously sharpens the models that guide what we test next," said Alucozai. "For a patient with a one-of-a-kind mutation, no trial will ever be big enough. Evidence has to come from understanding the biology itself."

According to the authors, the central opportunity is no longer simply how to generate more evidence, but how to build a development system capable of learning from every experiment, every model and every treated patient.

The authors make the case that predictability in drug development will not come from any single company or product. Instead, it will depend on shared, reusable evidence assets, such as data standards, curated natural history datasets, regulatory-endorsed biomarkers and disease models, whose value grows every time they are used. Under this approach, each successful program makes the next one easier. A curated natural history dataset spares future developers from reconstructing how a disease progresses, and every qualified tool lowers the burden on subsequent studies that follow.

“Precision medicine needs precision evidence. When models and data are built to be reused, every experiment and every patient moves the whole field forward,” said Clancy.

The paper identifies neutral organizations as essential stewards of this infrastructure, because they can maintain shared repositories and standards while avoiding the conflicts of interest that arise when a single commercial party governs resources an entire field depends on. The authors also call for governance that aligns the interests of regulators, industry, patients and payers, and they conclude that public-private partnerships and precompetitive consortia play a central role in modern biomedical innovation.

“Extraordinary advances in biomedical science are fundamentally changing what is possible for patients, but the systems we use to evaluate new therapies have not evolved at the same pace,” said Klaus Romero, M.D., M.S., FCP, chief executive officer of C-Path. “The Predictability Paradox points to one of the most consequential opportunities to modernize drug development: our ability to engineer increasingly precise medicines is advancing faster than our ability to generate the evidence required to bring them to the people who need them. Addressing this challenge requires a new evidence-generation enterprise — one that reduces scientific and regulatory uncertainty, makes optimal use of human-relevant data, and transforms knowledge generated for one therapy into actionable evidence for many others. Dr. Alucozai and Dr. Clancy have given the field a clear way to see why that matters.”

Building that kind of evidence enterprise has been C-Path’s role since its founding in 2005. Every new medicine is a chain of high-stakes decisions made under uncertainty about the right patients, the right dose, the right drug and the right trial. C-Path leads the shared architecture for evidence and decision-making the industry relies on. It builds the data, models and methods that turn uncertainty into evidence teams can act on, and creates the neutral environment where competitors, regulators, researchers and patient groups work together on problems no single organization can solve alone.

Two current initiatives show how that work targets the Predictability Paradox directly. C-Path’s New Approach Methodologies Developer Coalition, a collaboration of global NAMs leaders, seeks to engage with industry, regulators, and other stakeholders to advance new, human-relevant methods and build the shared standards that give everyone confidence in them, so that promising approaches can be used consistently across the field rather than validated one program at a time.

C-Path’s One to Millions initiative tackles the paradox at the level of individualized therapies. Anchored in FDA’s latest frameworks, including its plausible mechanism framework for individualized therapies, and aligned with emerging global regulatory science approaches, One to Millions is built on a centralized, regulatory-grade data platform. The platform brings together preclinical, clinical and real-world evidence; manufacturing and quality standards; regulatory tools and biomarkers; and long-term patient registries. The initiative also builds in early, sustained engagement with payers. Its goal is a scientifically grounded and economically sustainable pathway that allows therapies designed for a single patient to scale predictably from one patient to many to millions, while preserving the rigor that therapeutic innovation depends on.

Together, these efforts lead to better decisions, stronger programs and a development system the whole field can trust.

The full paper is available open access at jprecisionmedicine.org.

About Dr. Milad Alucozai

Milad Alucozai, DrPH, MPH, M.Sc., joined C-Path's Board of Directors in June 2026. He is a San Francisco-based computational neuroscientist, serial entrepreneur and first-check investor who works where AI, data and human biology meet, and a longtime leader in advancing human-relevant New Approach Methodologies (NAMs). He is co-founder and general partner of Pamir Ventures and co-founder of Revalia Bio. He is an external advisor to Amgen and serves as a Strategic Expert in Residence supporting ARPA-H. Business Insider named him one of the top 100 early-stage investors.

About the Center for Precision Medicine and Data Sciences

The Center for Precision Medicine and Data Sciences (CPMDS) at UC Davis is a hub for leading-edge research, interdisciplinary collaboration, and innovation in precision medicine. Our mission is to leverage advanced multi-omics, artificial intelligence, and computational modeling to drive personalized healthcare solutions and improve patient outcomes. CPMDS works at the intersection of genomics, bioinformatics, pharmacogenomics, and clinical medicine to uncover disease mechanisms and optimize patient-specific interventions. For more information, visit https://health.ucdavis.edu/precision-medicine/.

About Critical Path Institute

Founded in 2005 as a public-private partnership in response to the FDA's Critical Path Initiative, C-Path's mission is to lead collaborations that advance better treatments for people worldwide. Globally recognized as a pioneer in accelerating drug development, C-Path has established numerous international consortia, programs and initiatives that currently include more than 1,600 scientists and representatives from government and regulatory agencies, academia, patient organizations, disease foundations and pharmaceutical and biotech companies. With dedicated team members located throughout the world, C-Path's global headquarters is located in Tucson, Arizona, and C-Path's Europe subsidiary is headquartered in Amsterdam, Netherlands. For more information, visit c-path.org.

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