A Data Collaborative Case Study

Accelerating Medicines Partnership

Improving Drug Research Efficiency through Biomarker Data Sharing

Michelle Winowatan, Andrew Young, and Stefaan G. Verhulst

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EXECUTIVE SUMMARY

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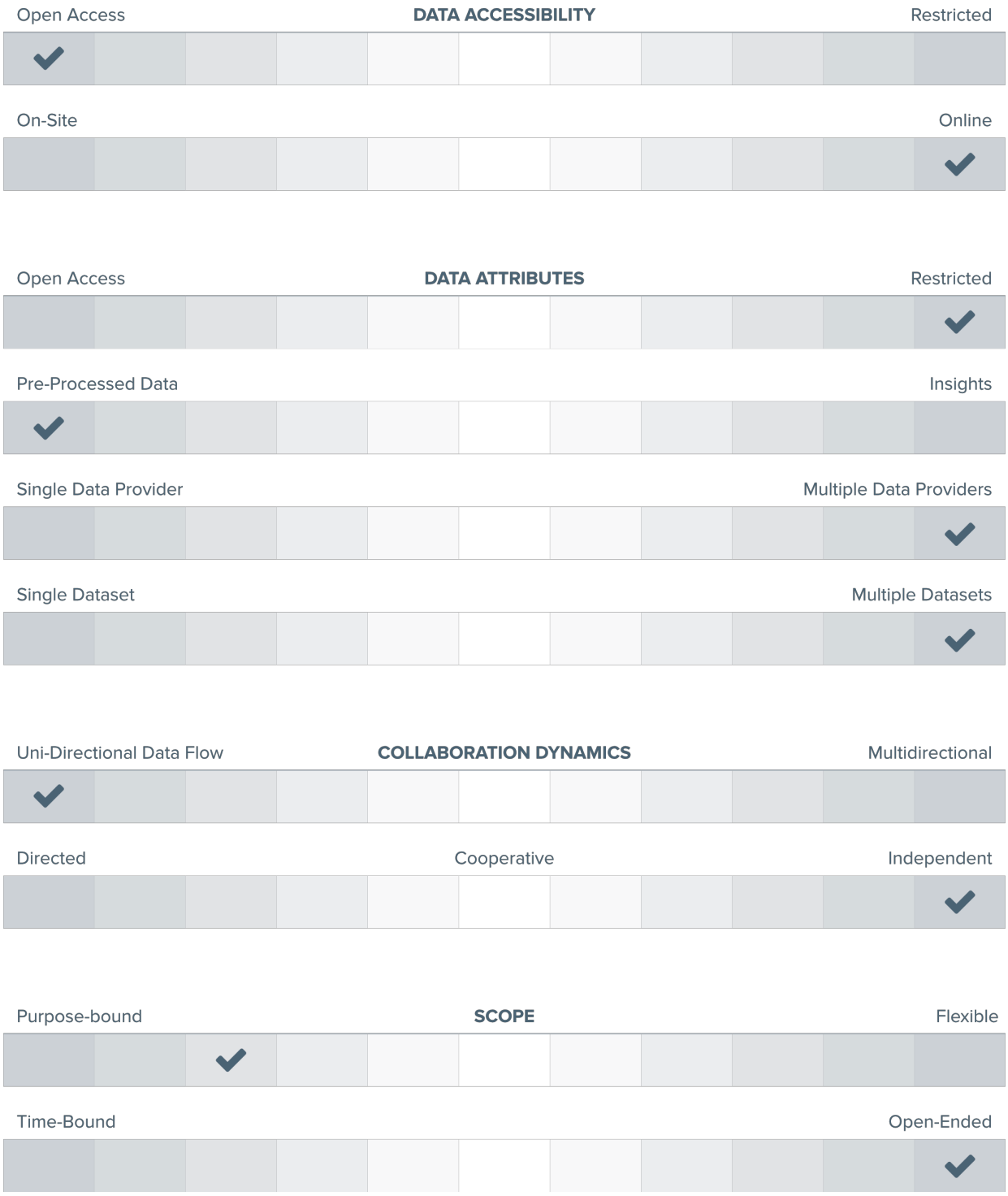
Summary: Accelerating Medicines Partnership (AMP) is a cross-sector data-sharing partnership in the United States between the National Institutes of Health (NIH), the Food and Drug Administration (FDA), multiple biopharmaceutical and life science companies, as well as non-profit organizations that seeks to improve the efficiency of developing new diagnostics and treatments for several types of disease. To achieve this goal, the partnership created a pre-competitive collaborative ecosystem where the biomedical community can pool data and resources that are relevant to the prioritized disease areas. A key component of the partnership is to make biomarkers data available to the medical research community through online portals.

Data Collaboratives Model: Based on our typology of data collaborative models, AMP is an example of the *data pooling* model of data collaboration, specifically a *public data pool*. Public data pools co-mingle data assets from multiple data holders—in this case pharmaceutical companies—and make those shared assets available on the web. Pools often limit contributions to approved partners (as public data pools are not crowdsourcing efforts), but access to the shared assets is open, enabling independent re-uses.

Data Stewardship Approach: Data stewardship is built into the partnership through the establishment of an executive committee, which governs the entire partnership, and a steering committee for each disease area, which governs each of the sub-projects within AMP. These committees consist of representatives from the institutional partners involved in AMP and perform data stewards function including enabling inter-institutional engagement as well as intra-institutional coordination, data audit and assessment of value and risk, communication of findings, and nurture the collaboration to sustainability.



Accelerating Medicines Partnership Data Collaborative Operational Variables. Detailed description of each variable can be found here.

Setting the Scene

Developing a new drug or treatment is a time- and resource-intensive effort. The move from early discovery to FDA approval can take more than a decade.[1] After obtaining the Investigational New Drug (IND), a license for doing clinical research, drug trials have to go through three phases before a New Drug Application (NDA) can be submitted for approval.[2] Phase I usually takes several months, involving a study with 20–100 participants and seeks to find a safe dosage. Phase II between several months and two years, requiring a study with several hundred participants to test the efficacy and side effects of the drug. Phase III takes one to four years, requiring a study with 300 to 3,000 study participants to further address concerns of efficacy and monitoring of adverse reactions in a larger sample study. A significant portion of drug research fails in Phase II or III, and, in the end, less than 5 percent of drug development efforts are successful. As a result, it can cost more than $1 billion to produce an effective diagnostic or treatment.[3]

Experts see sluggish productivity and high failure rate in drug discovery in the past decade and attribute it to poor linking of diseases with the right biomarkers.[4] Biomarkers are "biological characteristics that can be objectively measured and evaluated as an indicator of normal biological processes, pathogenic processes, or pharmacological responses to a therapeutic intervention."[5] These biomarkers, in other words, signal the presence or state of a disease, and changes in those biomarkers can signal the efficacy of a drug targeting that disease. For example, the biomarker HbA1c is used to diagnose prediabetes and diabetes.[6] Knowing this target helps physicians develop a treatment to impact the identified marker. Without the right targets, finding an effective treatment or cure becomes challenging.

Recent advances in genome sequencing technology enabled the identification of biomarkers more accurately.[7] Private pharmaceutical companies produced much of this knowledge. However, this information existed in silos and was not accessible by the wider medical research community. Dispersed and siloed drug research information can hamper the development of new and effective treatments.

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[1] "Accelerating Medicines Partnership (AMP)," National Institutes of Health (NIH), accessed September 9, 2019, https://www.nih.gov/research-training/accelerating-medicines-partnership-amp.

[2] Office of the Commissioner, "Step 3: Clinical Research," *FDA*, April 18, 2019, http://www.fda.gov/patients/drug-development-process/step-3-clinical-research.

[3] "Accelerating Medicines Partnership (AMP)," *supra* note 1.

[4] Wen Hwa Lee, "Open Access Target Validation Is a More Efficient Way to Accelerate Drug Discovery," *PLOS Biology* 13, no. 6 (June 4, 2015): e1002164, https://doi.org/10.1371/journal.pbio.1002164.

[5] Richard Mayeux, "Biomarkers: Potential Uses and Limitations," NeuroRx 1, no. 2 (April 2004): 182–88.

[6] Brenda Dorcely et al., "Novel Biomarkers for Prediabetes, Diabetes, and Associated Complications," Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy 10 (August 14, 2017): 345–61, https://doi.org/10.2147/DMSO.S100074.

[7] Patricia Carrigan and Thomas Krahn, "Impact of Biomarkers on Personalized Medicine," in *New Approaches to Drug Discovery*, ed. Ulrich Nielsch, Ulrike Fuhrmann, and Stefan Jaroch, Handbook of Experimental Pharmacology (Cham: Springer International Publishing, 2016), 285–311, https://doi.org/10.1007/164_2015_24.

Establishing the Data Collaborative

The ultimate purpose of this project is to help scientists focus their resources on promising targets and improve the success rate of drug development, by pooling together funding, expertise, and biomarkers data from multiple partners.[8] The pre-competitive nature of the data collaboration is key in getting engagement from the private-sector partners.

The partnership was initially launched in February 2014 with 3 distinct areas of focus: 1) Alzheimer's disease (AD); 2) type-2 diabetes; (T2D), and 3) autoimmune disorders of rheumatoid arthritis (RA) and systemic lupus erythematosus (lupus). A select group of pharmaceutical companies, academics, scientists, and representatives from the NIH and FDA defined these focus areas through a series of convenings held over the course of approximately six months before the project formed.[9] The partners determined which disease areas were both pressing and would benefit most from an information-sharing effort.[10] The outcome of this discussion was a white paper outlining the findings, which was subsequently used by the NIH and the partners to determine what resources to allocate for the AMP.[11]

The first project phase involved the NIH, 10 biopharmaceutical companies and several nonprofit organizations. Four years after its genesis, AMP launched a fourth project on Parkinson's disease (PD) in February 2018 with 9 partners. A breakdown of these partners are as follows:

	AD	T2D	RA and Lupus	PD
Government	• NIH • FDA	• NIH	• NIH	• NIH/NINDS • FDA
Industry	• AbbVie • Biogen • GlaxoSmithKline • Elli Lilly	• Janssen • Lilly • Merck • Pfizer • Sanofi	• AbbVie • Bristol-Myers Squibb • Janssen • Merck • Pfizer • Sanofi • Takeda	• Celgene • GlaxoSmithKline • Pfizer • Sanofi • Verily

[8] "Accelerating Medicines Partnership (AMP)," *supra* note 1.

[9] David Wholley, The GovLab's Interview with David Wholley, Director of Research Partnerships, Foundation for the National Institutes of Health, July 30, 2019.

[10] David Wholley, *supra* note 6.

[11] *Ibid.*

Nonprofit	• Alzheimer's Association • Foundation for the NIH • Geoffrey Beene Foundation • USAgainstAlzheimer's	• American Diabetes Association • Foundation for the NIH • Juvenile Diabetes Research Foundation	• Arthritis Foundation • Foundation for the NIH • Lupus Foundation of America • Lupus Research Alliance • Rheumatology Research Foundation	• Foundation for the NIH • Michael J. Fox Foundation

Table 1: AMP Partners

The data-sharing effort facilitated by the AMP aims to open access to biomarkers and help scientists identify biological targets that respond to new treatments. Leveraging AMP funding, the partners make their data available to the biomedical community through online portals. AMP partners invested more than $360 million over five years for research in the four disease areas, with more than half of the funding provided by the NIH.[12]

The Foundation for the National Institute for Health (FNIH) directs the initiative through the an executive committee.[13] The committee manages four steering committees for the four different projects. The executive committee and steering committees consist of representatives from partners in both the public and private sectors participating in the projects. The steering committees meet regularly to review progress and challenges facing the projects.

Outcome and Impact

Intended Impact

The AMP intends to accelerate the discovery of new drugs, by first increasing the efficiency of drug research, identifying the most promising biological targets for drug development to reduce research time and provide for a higher chance of successful trial.[14] Second, the partnership intends to improve the process of clinical trials by providing scientists with the most promising biological targets so trials can be done on patients most likely to respond well to the treatment based on the molecular profiles of their disease. Third, it seeks to increase the number and effectiveness of new targeted therapies, reduce failures in Phase II and Phase III clinical trials—testing phases that require a higher number of study participants and whose objectives are to identify efficacy, side effects, and adverse reactions to the treatment—and increase investment in drug development.

The underlying mechanism employed to realize these objectives is pre-competitive data collaboration, which enables medical researchers to leverage data and apply their time and

[12] Elie Dolgin, "Massive NIH–Industry Project Opens Portals to Target Validation," *Nature Reviews Drug Discovery* 18 (February 27, 2019): 240–42, https://doi.org/10.1038/d41573-019-00033-8.

[13] "Accelerating Medicines Partnership (AMP)," *supra* note 1.

[14] *Ibid.*

resources only to the most promising drug candidates. It also prevents scientists from repeating research that has been done previously by opening biomarker data freely to the medical community. Overall, the sharing of data seeks to improve the efficiency and accelerate the discovery of new drugs.

Outcomes to Date

An article in *Nature* discussing the implementation of AMP after five years says "[industry] insiders cannot yet point to drug candidates that owe their origins to AMP — and researchers who study precompetitive research models say that's to be expected."[15] In the article, Hilde Stevens of the Institute for Interdisciplinary Innovation in healthcare suggests it would be premature to come to a verdict on AMP since the project is just starting to lay out the foundational elements for information sharing and collaboration in the four disease areas. David Wholley—the Director of Research Partnership at the Foundation for the National Institutes of Health (FNIH) who manages the AMP—confirmed this in an interview, saying that intellectual property factor allows the company not to disclose the specific biomarkers that they are using in their research, making it challenging to trace drug discovery to AMP.

Increased Efficiency: That said, insights from AMP members signal that the initiative has demonstrated increased efficiency in their drug research process. The same *Nature* article says "the public–private partnership has helped them focus their R&D activities, stopping programmes that seem less biologically relevant, accelerating others and revealing new targets potentially worth pursuing in the future." Aris Baras, head of the Regeneration Genetics Center, further indicates how the AMP has been useful for researchers, including those outside of the partnership. He says says his team now routinely crosschecks their research findings against data provided in AMP portals.[16]

Replication for Other Diseases: AMP also inspired collaboration for other disease areas. In 2017, the NIH launched Partnership for Accelerating Cancer Therapy (PACT)—a different initiative with a similar data sharing model—with 12 drug companies. It is a five-year project with $220 million funding. Although, this research partnership was not included under AMP because PACT was funded through the Cancer Moonshot initiative—an NIH program that seeks to accelerate cancer research.[17] In February 2019, AMP added another branch for schizophrenia.[18]

Risks and Risk Mitigation

The data shared through this partnership—biomarkers data—does not contain patient health record or any personally identifiable information. As mentioned previously, biomarkers are "biological characteristics that can be objectively measured and evaluated as an indicator of

[15] Elie Dolgin, *supra* note 9.
[16] *Ibid.*
[17] *Ibid.*
[18] Elie Dolgin, *supra* note 9.

normal biological processes, pathogenic processes, or pharmacological responses to a therapeutic intervention."[19] As such, the sharing of this information does not pose privacy risks.

NIH, whose director is appointed by the President, drives AMP. Since 1960, the director of the NIH has changed as the administration changes. Francis Collins, the current director of NIH, in an interview with STATA, expressed his concern that resource allocation to the organization could be affected by political fluctuation, which might affect NIH's research programs, including AMP.[20]

Lessons Learned – Enablers

Collaborative approach in agenda setting and governance. AMP formed around a series of discussions among different stakeholders, which included private-sector actors, academics, scientists, the NIH, and FDA. The collaborative approach that the parties employed to determine the disease areas, as well as the goals of each research project, enabled the establishment of the partnership and the allocation of funding to support it. Furthermore, the partnership also created an executive committee that governs the entire project and a joint steering committee for each of the research areas. These committees meet regularly to make decisions on how to allocate resources for the projects.[21]

A trust ecosystem among the private-sector partners. Pharmaceutical companies can lose their competitive edge by sharing research data. Therefore, a trust ecosystem with clear parameters on what data is shared, while incorporating some kind of incentives, is key to addressing this issue. The emphasis on pre-competitive collaboration is one of the factors that mitigates concerns related to comparative advantage for participating companies.[22] Although pre-competitive data sharing has its own challenges (i.e. intellectual property challenges bureaucracy, and antitrust issues), there are some clear benefits that can be generated from this practice, as discussed above.[23] The collaborative approach outlined above helps build trust between the private sector actors.

Strong and collaborative financial support. The financial structure of the partnership also helps to minimize competitive concerns among partner companies. Government, industry, and nonprofit partners collaboratively fund AMP. The NIH does provide a significant amount of the funding, however, at $230 million out of $360 million.[24] Nonetheless, this shared financial burden likely helps to create buy-in across companies and institutions.

Direct engagement from decision makers. Engagement with decision makers from each of the organizations involved made this partnership possible. The involvement of Francis Collins, the

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[19] Mayeux, *supra* note 5.

[20] "NIH's Francis Collins on Obama, Congress, and His One Regret." Accessed September 9, 2019. https://www.statnews.com/2016/12/16/nih-francis-collins-interview/.

[21] David Wholley, *supra* note 6.

[22] *Ibid.*

[23] Eric Gastfriend and Bryan Lee, "Pre-Competitive Collaboration in Pharma" (Future of Life Institute, n.d.), https://futureoflife.org/data/documents/PreCompetitiveCollaborationInPharmaIndustry.pdf

[24] Elie Dolgin, *supra* note 9.

director of NIH, in the project from the very beginning played an important role in attracting similar involvement from high-level decision makers in partner companies and institutions.[25]

Lessons Learned – Challenges

Navigating different cultures and interests among actors from different sectors. According to David Wholley, bringing individuals from different sectors was not an easy task due to the difference in objectives of each of the actors. Academic researchers tend to gravitate toward doing open-ended research projects, while companies tend to focus on specific research objectives with clear pathways toward financial benefits.[26]

Assessing direct industry impacts. The data shared in this collaborative has shown to be a valuable source for researchers. Still, as mentioned previously, it is difficult to trace the direct contribution of AMP to drug candidates due to intellectual property concerns. While academic researchers must cite the AMP in their publications, private sector actors are reluctant to divulge which biomarkers they are using in their research in order to maintain competitive advantage.[27]

TABLE 1 | ACCELERATING MEDICINES PARTNERSHIP FUNDING LEVELS

Disease	Industry members	NIH funding	Industry funding	In-kind contributions	Non-profit funding	Total
Alzheimer disease	AbbVie, Biogen, Eli Lilly and GlaxoSmithKline	$162 million	$22.2 million	$40 million	$1 million	$225.2 million
Diabetes	Eli Lilly, Janssen, Merck, Pfizer and Sanofi	$31 million	$21.5 million	$6.5 million	$0.3 million	$59.3 million
Rheumatoid arthritis and lupus	AbbVie, Bristol-Myers Squibb, Janssen, Merck, Pfizer, Sanofi and Takeda	$24.9 million	$25.5 million	$0 million	$1.2 million	$51.6 million
Parkinson disease	Celgene, GlaxoSmithKline, Pfizer, Sanofi and Verily	$12 million	$8 million	$2 million	$2 million	$24 million

Table 2: AMP Funding (Nature, 2019)

[25] David Wholley, *supra* note 6.
[26] *Ibid.*
[27] *Ibid.*

Next Steps

As of September 2019, the AMP is in its fifth year. It has created a model of data sharing for other disease research, such as the PACT mentioned above. In February 2019, AMP approved plans to add a fifth project focusing on schizophrenia.[28]

David Wholley tells *Nature* that there are ongoing discussions about creating "AMP 2.0". Additionally, disease indicators generated through this partnership can be used as diagnostic aids and tools for patient stratification in future trials.[29] Ultimately, they hope to move on to therapeutic target identification as well.

In an interview with The GovLab, Wholley said the AMP is developing a survey for all the participants to evaluate the impact of AMP on drug research and get insights on whether the data sharing initiative has been useful to the companies. Specifically, if the sharing of biomarkers data has made a difference in drug research process and discovery. The result of this survey would inform the partners on how to further improve the collaboration in the future.

[28] Elie Dolgin, *supra* note 9.
[29] *Ibid.*

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