



Project INSIGHT: A Big Data Research Collaboration to Advance Alzheimer's Drug Development, Treatment, and Care – and Stop Disease by 2025



Intensive Treatment and Severe Hypoglycemia Among Adults with Type 2 Diabetes

What is the association between intensive treatment, clinical complexity, and incidence of hypoglycemia among adults with type-2 diabetes not using insulin?



2016

OptumLabs in review

Improving care and increasing patient value through collaborative discovery and innovation.

2016

OptumLabs in review



The OptumLabs 2016 portfolio of activities showcases progress towards our mission to improve patient care and patient value. With data science, discovery and collaboration at the core, we expanded our work through new partnerships, geographies, programs, innovations and engagement models.

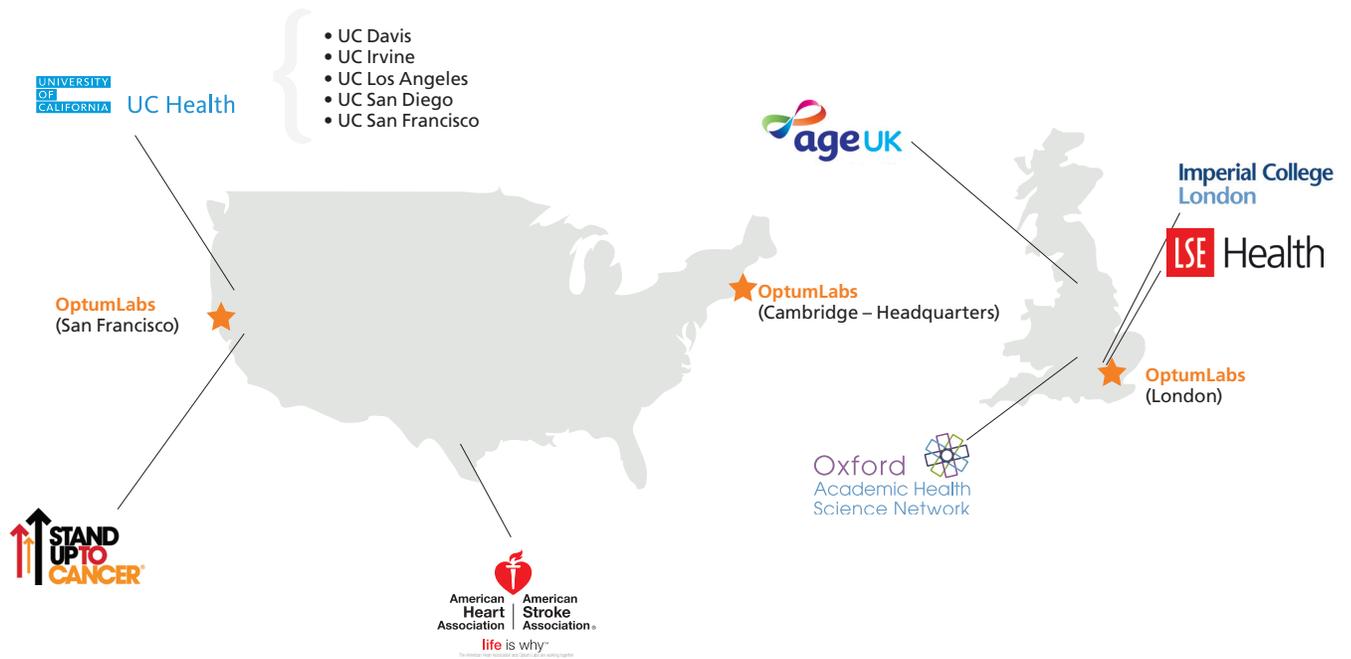
Since inception, more than 60 principal investigators supported by teams of researchers and data scientists from across our collaborative have leveraged the OptumLabs data to publish in journals and present at national and global conferences. Bodies of work around specific diseases and research topics are emerging, and multi-stakeholder integrated programs are tackling some of the biggest challenges in health care. Data driven innovations are emerging via predictive models, as well as development of applications that reveal the impact of local factors on population health and leverage leading edge data science techniques to look at optimizing network design.

Over the past year, diverse new partners joined our community and we expanded our presence geographically – opening offices on the west coast and in the U.K.. Our annual Research & Translation Forum convened the largest combination of partners and thought leaders to date with a focus on the data-driven path to value.

We're excited to share this overview of our efforts to accelerate improvements to health and health care in 2016.

NEW PLACES AND FACES

In 2016, we welcomed seven new partner organizations and launched two new locations — one in San Francisco, California, and another in London, United Kingdom. Our West Coast location brings us closer to connected health and technology partners while our presence in London enables us to contribute to the data conversation in the U.K. and the mission to accelerate improvements in health care through data-science and discovery.



SCIENCE AND DISCOVERY

2016

RESEARCH PORTFOLIO AT A GLANCE:



25 PROJECT PROPOSALS
from **26** principal investigators
across **11** PARTNER INSTITUTIONS

50+ CONFERENCE PRESENTATIONS
at national and global conferences



DIVERSE PROJECTS UNDERWAY

across research categories	utilization	epidemiology	safety	comparative effectiveness
	methods	prediction	economics	policy
and health domains	cardiovascular	multimorbidity	oncology	diabetes
	prevention	orthopedic	diagnostics	neurology

GROWING PIPELINE for grant funded projects



4 Four projects awarded by NIH and FDA — with many additional applications in process

New cross-partner RESEARCH COLLABORATIONS

University of Minnesota + Harvard + Mayo Clinic + Yale

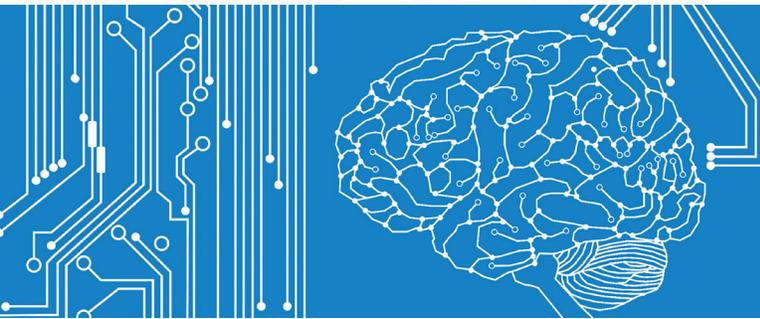
Diffusion of Clinical Evidence into Practice: Physician Networks, Delivery Organizations and Markets

AMGA + Medica Research Institute

Development and Validation of Primary Care Practice Structure Measures for Use in Quality Improvement Activities

26 PUBLICATIONS *of* RESEARCH OUTCOMES IN HIGH-IMPACT JOURNALS
including:

- JAMA
- Circulation
- Diabetes Care



INTEGRATED PROGRAMS

Our multi-stakeholder integrated programs are tackling some of the biggest challenges in health care.

PROJECT INSIGHT: A big data research collaboration to advance Alzheimer’s drug development, treatment and care – and stop the disease by 2025



Expert advisory panel includes members from AARP Services Inc, Age U.K., AMGA, Banner Alzheimer’s Institute, Billings Clinic, Boston University, CMS, Mayo Clinic, Optum International, Oxford University, United Healthcare and University of Maryland National Health Council.

Phase 1 projects nearing completion and translation underway:

- **Aim 1: Can we diagnose dementia earlier and more accurately?**
Using administrative claims data, two complementary projects are comparing the predictive power of traditional and machine learning methods in diagnosing dementia.

- **Aim 2: Mining new data from clinical notes**
OptumLabs extracted new dementia-related terms from clinical notes to add to the clinical database that already includes a sizeable population of dementia patients and assessment data (e.g., MMSE, GAF, PHQs).

OPTUMLABS MEASURES PROGRAM

One year after launch, our measures program is well underway — facilitating the development of new patient-centered measures and filling priority gaps in health system measurement — with continued engagement from the National Quality Forum (NQF).

Current projects in motion include:

- **Quality measures for patients receiving home-based medical care** — AARP, Johns Hopkins University, University of California, San Francisco, AMGA and PCPI — creating new measures to address the care of homebound individuals and other vulnerable patient populations. Collaborators have defined a denominator for those receiving home-based care and will present at the 2017 International Association for Geriatrics and Gerontology.
- **Identification of clinically relevant homogeneous multimorbidity groups from large administrative medical data using data mining methods** — Mayo Clinic — developing phenotypes of individuals with multiple chronic conditions using advanced machine learning methods. Phenotype clusters have been developed and are currently evolving to fully support risk adjustment and non-condition specific measures.

OptumLabs Measures Program

Enabling data-driven advancements in quality measurement



Lina Walker, PhD, Vice President of Health Security, AARP Public Policy Institute, announces the AARP Measures Innovation Grant winners at the 2016 Research & Translation Forum



- *Alzheimer's/Dementia-specific performance measures development* — University of Maryland, Baltimore + OptumLabs — evaluating medication use measures in Alzheimer's disease and other forms of dementia to identify new opportunities for quality improvement.

AARP MEASURES INNOVATION PROGRAM

AARP collaborated with OptumLabs and NQF to introduce a new engagement program in the fall of 2016. The AARP Quality Measures Innovation Grant Program is designed to sponsor multi-partner projects aimed at developing and/or testing novel quality measures — leveraging OptumLabs data and addressing important gaps in care.

We received 24 proposals and AARP announced the three grant awardees at the 2016 Research & Translation Forum:

- *Evaluation of pain treatment outcomes among seriously ill patients* — American Academy of Hospice and Palliative Medicine + AMGA
- *Appropriateness of glucose-lowering therapy among adults with type 2 diabetes* — Mayo Clinic + Yale
- *Anticoagulant use and events associated with bleeding* — Pharmacy Quality Alliance + University of Maryland, Baltimore

Projects aim to deliver results by the end of 2017 and present at the 2017 Research & Translation Forum.

TRANSLATION

The 2016 OptumLabs Translation Program fostered strong collaboration between key translation partners to deliver new products and programs to take the work of OptumLabs further.



Major achievements include:

- Translation Advisory Team and Strategic Research Communications Board
 - Twenty-five preliminary project concept reviews and translation recommendations to principal investigators (PIs)
 - Seven PI interviews and group discussions on emerging project outcomes to support multi-stakeholder dissemination of published, high-impact results
 - Integrated communications campaigns for high impact publications
- Discovery Insight Brief series — developed overviews of high impact results contextualized in the current health care landscape to facilitate dissemination and translation
- Patient-Reported Outcomes Special Interest Group (PRO SIG) webinar series — exposed partners to the growing importance of PROs and PROMs in patient-centered research and clinical care

INNOVATION

NATURAL NETWORKS — GRAPH ANALYTICS TO DESIGN A BEST-IN-CLASS PROVIDER NETWORK

Key advances in machine learning and big data are enabling payers to study provider networks as dynamic social networks — rather than a set of contracts.

Using UnitedHealthcare claims data, OptumLabs data scientists created a prototype of a network design tool that applies graph analytics to identify clusters of providers that collaborate in the care of members. Graph analytics, a type of machine learning, is used by social networking companies to recommend friends or products to their members. The team has shown these informal networks of trust — or Natural Networks — among providers can achieve better outcomes for members.

The OptumLabs team is currently developing a drag-and-drop application to help build provider networks and estimate the benefits and impacts of new network designs.



OPTUM COMMUNITYHEALTH — TOUCHSCREEN APPLICATION INFORMS PRODUCTS AND SERVICES

Optum CommunityHealth (OCH) is a dataset that enables us to understand how local factors — social determinants, community outcomes, health system attributes — influence the health of particular populations.

UHC National Account teams are leveraging OCH to identify and tailor plans and services to the specific needs of large national employers.

DATA ENHANCEMENTS AND KNOWLEDGE SHARING

ADVANCING THE OPTUMLABS DATA ASSET

Our data set is always evolving to generate new insights and discoveries. 2016 advancements include:

- New clinical data model — standardized model with additional attributes and data from structured fields, and information derived from physician notes via Natural Language Processing (NLP). OptumLabs created a user guide to accompany this data for all partners.
- Health plan paid amounts — when coupled with patient out-of-pocket payment amounts, enables researchers to quantify true total costs for care and explore the drivers of variations in these costs.
- County-level research view — claims data at the county level enriches research possibilities with county-specific information. The first external asset to be linked was the Area Health Resource File.
- Provider linking project — assigned a common identifier to providers that can be used across claims and clinical data. Prior to this initiative, researchers were unable to follow providers across the two data assets.
- Data available in Europe — enabled U.K. partners to access an anonymized claims data set to begin exploring research opportunities.



PARTNER BOOT CAMPS AND DATA DEEP DIVES

We train new and existing partners in applied uses of the OptumLabs data in tailored 1–2 day sessions, with a focus on how to best work with the data to maximize research insights and translation possibilities.

With a growing partnership and geographic footprint, we took our training sessions to new locations beyond our Cambridge headquarters in 2016.

- May | Cambridge, MA, with AMGA, AHA, ACS, London School of Economics, RPI, Tufts, UMN, Yale
- August | Eden Prairie, MN, with UMN, Mayo Clinic, Medica Research Institute & BSC
- October | Columbia, MD, with UMB, JHU, ACS, HHS
- November | San Francisco and Irvine, CA, with UC Health System

DATA USER GROUPS

We expanded our data user groups to focus on EHR data in addition to claims data, enabling partners to share, build and document collective wisdom working with the OptumLabs data asset.

U.K. PARTNER ROUNDTABLES HELP ADVANCE U.K. DATA AGENDA

OptumLabs and its partners in the U.K. are advancing a linked data agenda in Europe, initially through a series of partner-led roundtables to inform future publications and research projects. The roundtables held in 2016 included:

- OptumLabs and LSE Health: Data as a Public Good
- OptumLabs and Imperial College London: Steps toward a Learning Health System
- Oxford Academic Health Science Network (AHSN): U.K. Clinical Record Interactive Search (U.K. CRIS)

Our roundtable series will lead to descriptive white papers and potentially U.K. investigator-initiated research using U.S. claims data.

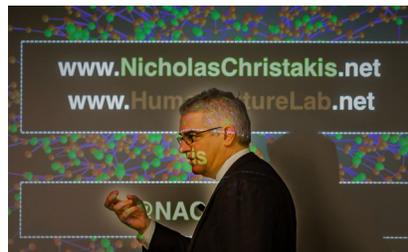
RESEARCH & TRANSLATION FORUM

Cambridge, MA. Nov 16-17, 2016. The 3rd annual OptumLabs Research & Translation Forum brought together the largest array of partners and thought leaders to date — from California to the U.K.. Our agenda was threaded by a theme — the data-driven path to value.

Attendees explored this concept through data science and translation pre-event workshops, keynote presentations, multi-stakeholder panel discussions, a partner-driven roving ideas exchange and all the conversations that happened in between.



Keynote Farzad Mostashari, MD, Aledade, kicks off the forum with *From Volume to Value: Technology Enabled Practice Transformation*.



Keynote Nicholas Christakis, MD, PhD, MPH, Yale University Human Nature Lab, helps us visualize *Social Networks and their Influence on Health*.



Keynote Ashish Jha, MD, MPH, Harvard Global Health Institute, leads a discussion on *Value in U.S. Health care: The Need for Better Data*.



Payer, provider and consumer views on value are compared in a panel featuring Lewis Sandy, MD, FACP, UnitedHealth Group; Jayant Talwalkar, MD, MPH, Mayo Clinic; Charlotte Yeh, MD, AARP Services, Inc. and moderated by Chief Medical Officer and Senior Vice President of Translation, Darshak Sanghavi, MD, OptumLabs.



How can data science drive value in personalized medicine? Chief scientific officer William Crown, PhD, OptumLabs leads a panel with diverse data science experts Chris Hane, PhD, MSOR, OptumLabs; Richard Weinshilboum, MD, Mayo Clinic and Martin Zand, MD, PhD, University of Rochester.



Attendees gather in small groups to explore 16 diverse partner projects and concepts during the Roving Ideas Exchange.

R&T Forum was by far my best health services research conference experience to date. In particular, I liked the diversity of the participants' areas of expertise and interest. I got to exchange ideas with clinicians, health services researchers, data scientists and even a chemical engineer (!) all under the same roof.

– Ashish Raj, MBBS, MSPH, PhD, Director of Outcomes Research, American Cancer Society

RESEARCH DISSEMINATION

Partners generated 26 publications using OptumLabs data in high-impact journals.

1. Yao X, Abraham NS, Alexander GC, et al. Effect of adherence to oral anticoagulants on risk of stroke and major bleeding among patients with atrial fibrillation. *J Am Heart Assoc*. 2016 Feb;5:e003074.
2. Crown W. Specification issues in a big data context: Controlling for the endogeneity of consumer and provider behaviours in healthcare treatment effects models. *PharmacoEconomics*. 2016 Feb;34(2):95-100.
3. McCoy RG, Nori VS, Hane CA. Development and validation of HealthImpact: An incident diabetes prediction model based on administrative data. *Health Serv Res*. 2016 Oct;51(5):1896-1918. Epub 2016 Feb 21.
4. Singh S, Heien HC, Sangaralingham LR. Comparative effectiveness and safety of infliximab and adalimumab in patients with ulcerative colitis. *Aliment Pharm Therap*. 2016 May;43(9):994-1003. Epub 2016 Mar 15.
5. Gershman B, Van Houten HK, Herrin J, et al. Impact of PSA screening trials and revised PSA screening guidelines on rates of prostate biopsy and post-biopsy complications. *Eur Urol*. 2017 Jan;71(1):55-56. Epub 2016 March 16.
6. Noseworthy PA, Yao X, Shah ND, Gershman BJ. Comparative effectiveness and safety of non-vitamin K antagonist oral anticoagulants versus warfarin in patients with atrial fibrillation and valvular heart disease. *Int J Cardiol*. 2016 April;209:181-183.
7. Madhavan M, Yao X, Sangaralingham L, et al. Ischemic stroke or systemic embolism after transeptal ablation of arrhythmias in patients with cardiac implantable electronic devices. *J Am Heart Assoc*. 2016 April;5:e003163.
8. Sangaralingham L, Shah ND, Yao X, Roger VL, Dunlay S. Incidence and early outcomes of heart failure in commercially insured and Medicare Advantage patients, 2006 to 2014. *Circ Cardiovasc Qual Outcomes*. 2016 May;9:332-337.
9. Morris JR, Bellolio MF, Sangaralingham LR, et al. Comparative trends and downstream outcomes of coronary CT angiography and cardiac stress testing in emergency department patients with chest pain: An administrative claims analysis. *Acad Emerg Med*. 2016 Sep;23(9):1022-30. Epub 2016 Sep 7.
10. McCoy RG, Lipska KJ, Yao X, Ross JS, Montori VM, Shah ND. Intensive treatment and severe hypoglycemia among adults with type 2 diabetes. *JAMA Intern Med*. 2016 June;176(7):969-978.
11. Noseworthy PA, Yao X, Shah N, Gersh BJ. Stroke and bleeding risks in NOAC- and Warfarin- treated patients with hypertronic cardiomyopathy and atrial fibrillation. *J Am Coll Cardiol*. 2016 June;67(25):3020-3021.
12. Yao X, Abraham NS, Sangaralingham L, et al. Effectiveness and safety of dabigatran, rivaroxaban, and apixaban versus warfarin in nonvalvular atrial fibrillation. *J Am Heart Assoc*. 2016 June 13;5(6).
13. Singh S, Heien HC, Sangaralingham LR, et al. Comparative effectiveness and safety of anti-tumor necrosis factor agents in biologic-naive patients with Crohn's disease. *Clin Gastroenterol Hepatol*. 2016 Aug;14(8):1120-1129.e6. Epub 2016 Apr 4.
14. Yao X, Sangaralingham LR, Ross JS, Shah ND, Talwalkar JA. Adoption of new agents and changes in treatment patterns for hepatitis C: 2010-2014. *Am J Manag Care*. 2016 June;22(6):e224-232.
15. Munoz FDC, Yao X, Abraham NS, et al. Dabigatran versus warfarin in relation to renal function in patients with atrial fibrillation. *J Am Coll Cardiol*. 2016 July;68(1):129-131.
16. Gillespie CW, Morin P. Few hip fracture patients receive osteoporosis care. *Insights on the Issues* 100. 2016 July. AARP Public Policy Institute, Washington, DC.
17. Brito JP, Schilz S, Singh Ospina NM. Antithyroid drugs – the most common treatment for Graves' disease in the United States: A nationwide population-based study. *Thyroid*. 2016 Aug;26(8):1144-1145. Epub 2016 Jul 5.
18. Noseworthy PA, Yao X, Abraham NS, Sangaralingham LR, McBane RD, Shah ND. Direct comparison of dabigatran, rivaroxaban, and apixaban for effectiveness and safety in non-valvular atrial fibrillation. *CHEST*. 2016 Sep;150(6):1302-1312.
19. Lipska KJ, Yao X, Herrin J, et al. Trends in drug utilization, glycemic control, and rates of severe hypoglycemia, 2006-2013. *Diabetes Care*. 2016 Sep;dc160985.
20. Kremers HM, Schilz SR, Van Houten HK, et al. Trends in utilization and outcomes of hip arthroscopy in the United States between 2005 and 2013. *J Arthroplasty*. Epub 2016 Sep 28.
21. Bellolio MF, Sangaralingham LR, Schilz SR, et al. Observation or inpatient: Impact of patient disposition on outcomes and utilization among emergency department patients with chest pain. *Acad Emerg Med*. Epub 2016 Oct 14.
22. Chi CL, Wang J, Clancy TR, Robinson JG, Tonellato PJ, Adam TJ. Big data cohort extraction to facilitate machine learning to improve statin treatment. *Western J Nurs Res*. 2016 Oct;39(1):42-62.
23. Motosue MS, Bellolio MF, Van Houten HK, Shah ND, Campbell RL. Increasing emergency department visits for anaphylaxis, 2005-2014. *J Allergy Clin Immunol Pract*. 2017 Jan-Feb;5(1):171-175.e3. Epub 2016 Nov 3.
24. Gillespie CW, Morin PE. Trends and disparities in osteoporosis screening among women in the United States, 2008-2014. *Am J Med*. Epub 2016 Nov 21.
25. Abraham NS, Noseworthy PA, Yao X, Sangaralingham LR, Shah ND. Gastrointestinal safety of direct oral anticoagulants: A large population-based study. *Gastroenterology*. Epub 2016 Dec 30.
26. Yao X, Stewart EA, Laughlin-Tommaso SK, Heien HC, Borah BJ. Medical therapies for heavy menstrual bleeding in women with uterine fibroids: A retrospective analysis of a large commercially insured population in the USA. *BJOG*. 2017 Jan;124(2):322-330. Epub 2016 Oct 21.



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