

TECHNOLOGY

IMPACT at SCALE

Ascending to new heights; scaling data access, teams, and technology to improve patient care.

TECHNOLOGY INNOVATION CENTER 2018 ANNUAL REPORT



Contents

O1 Letter from Leadership: Scaling Care Transformation in Three Dimensions

₍) TEAM

- **02** Growing Through Differences
- 04 Mission & Core Values: Valuing Impactful Change
- **05** Connecting Through New Mediums

FEATURED APPLICATIONS

- 06 MRI Dashboard: Identifying & Solving for MRI Delays
- **08 MS Visualization:** Helping Patients See Patterns in their Disease
- **10 Rubicon:** Coordinating the Complexities of Pediatric Sepsis Care
- 12 HealChat: Taking Secure Clinical Communications Beyond Johns Hopkins

PRODUCT UPDATES

14 Active Care: Increasing Control & Comfort for Men with Prostate Cancer

15 EpiWatch: Bringing Seizure Detection to Consumer Wearables



- **16 HEXCITE:** Building Bedside Entrepreneurs
- **18 LEADS:** Shaping Skilled Data Stewards
- 20 CAMP: Enabling Biomedical Discovery



22 Expanding Precision Medicine through Shared Technology & Process

ANNUAL EVENT

24 Johns Hopkins Digital Health Day: Building a Digital Health Ecosystem

BY THE NUMBERS

26 Tallying TIC Impact

SPECIAL THANKS

28 Collaborating with Like-Minded Innovators

30 Anatomy of a Technology Innovation Center

Contributors



Editor-in-Chief: Jasmine McNeil

Staff Writer: Emily Marx



Q

Graphic Designer: Amy Hushen

Editors: Patrick Ostendarp, Ashleigh Griffin, Lisa Sparks



Since our founding in 2014, the Johns Hopkins Medicine Technology Innovation Center (TIC) has aspired to catalyze organizational transformation at Johns Hopkins. We support innovators by laying the foundations for change – transforming research and applying insights to clinical care.



ccelerating discovery and expanding care to improve health outcomes drives our strategy in three dimensions:

The first dimension of scaling is up. We enable discovery at Johns Hopkins Medicine by eliminating barriers to data-driven research. The inHealth Precision Medicine Analytics Platform (PMAP) is the technical embodiment of this vision, providing disease-specific clinical and research teams with the computational capacity to apply data science, leading to precise diagnoses and intervention. Recently, PMAP has been used to apply computer vision algorithms to brain MRIs, allowing for subgrouping and disease progression tracking of multiple sclerosis patients. This medical image analysis infrastructure can aid other clinical research efforts in a wide range of diseases utilizing image processing pipelining.

But technology is not enough. Transformation at its heart is about human change. This brings us to a second dimension: scaling across. In 2018 we launched the first CAMP (Center of Excellence Analytics in Medicine



Paul Nagy, PhD Deputy Director, Technology Innovation Center, Associate Professor of Radiology, Johns Hopkins University Schools of Medicine

SCALING CARE TRANSFORMATION IN THREE DIMENSIONS

Program). CAMP is a 12-week leadership course bringing together current and prospective investigators to learn how to conduct data-driven research on PMAP. We taught 70 faculty and staff representing 16 clinical disease research teams in our first cohort. By providing our world-class researchers with the tools and teams to answer their most impactful research questions, we're speeding up new discovery, sustainably.

The third dimension of scaling - out is our delivery of new discoveries to improve patient care. The TIC collaborates with inventors to turn discoveries into software solutions that allow clinicians to immediately deliver better care to their patients. We develop EMRintegrated, clinical decision support tools using design thinking practices coupled with usability-centered software development. The result is new risk predictors, views into historical treatment patterns, and just-in-time information for clinicians and patients to make more informed decisions about care.

The next step to scaling is driving greater adoption in these three dimensions, cultivating transformation so it can take root at every corner of Johns Hopkins, and leading the way care is delivered across the globe.

Dwight Raum

Dwight Raum Executive Director, Technology Innovation Center, Vice President and Chief Technology Officer for The Johns Hopkins University and the Johns Hopkins Health System



TEAM

Growing

THROUGH

DIFFERENCES

The TIC is a team of leaders, engineers, designers, and data analysts who combine forces to create novel healthcare IT solutions. In 2018, the TIC grew to a team of 30.

• • • •

Team member differences contribute to the TIC's strength and growth. Skills range from user experience design to clinical integration, from data visualization to managing leadership programs.

TEAM STATS

2018 TEAM BREAKDOWN



20 Engineering Team



Data Analytics Team

8 BABIES (SINCE 2014)







3

്രി

Valuing Impactful Change

Mission

At the Technology Innovation Center, our mission is to collaborate with clinical researchers and clinicians to improve patient care through medical software.



Core Values

Practice Patient-Centeredness:

Consider the impact on the patient as central to what we build

Challenge What's Usual:

Take initiative, be relentless, and stay curious

Take a Team-Based Approach:

Stay passionate about learning new technology and co-innovate

Lead by Serving:

Value crossdisciplinary perspectives and collaboration

Johns Hopkins Tech Hub Coming 2019!

Johns Hopkins faculty, staff, students, and affiliates will soon have a place to shop for and explore technology on the East Baltimore campus to aid their professional and personal lives. Workstation hardware equipment from vendors like Apple, Dell, and Microsoft can be purchased and serviced by IT@JH professionals. The JH Tech Hub will feature a software Testing Lab hosted by the TIC, open to Johns Hopkins affiliates who would like to test out a showcase of medical software solutions.

The Johns Hopkins Tech Hub is located on the ground floor of the Rangos Building at the corner of Ashland Avenue and North Wolfe Street.

Connecting Through New Mediums





TIC has a Fresh Web Presence

In Winter 2019 we launched a new website to better align with our mission of improving patient care with innovative medical software solutions. The website's modern interface speaks to the vibrant culture at the TIC and provides a more complete view into the team's interworkings.

0

0

Learn about the team's diverse expertise in areas like user experience design, software development, and data analytics.

View case studies that show solution life cycles from concept to impact using projects from the TIC's work portfolio.

Browse leadership programs for entrepreneurialism, data stewardship, and precision medicine including application details.

Visit us at: TIC.JH.EDU

MRI Dashboard: Identifying & Solving for MRI Delays



Two years ago, Samantha Mueller, Chief Imaging Technologist in the Radiology MRI department at Johns Hopkins Hospital, knew patients were experiencing significant delays in getting MRIs, but she couldn't pinpoint why.

Dument	empred, tailed	Future Order	Inclure needs 1.57 Intercenter Needed Intercente			
panent -	engeed raied	Puture Order	IFCERE MARSS 7.51 EXPOSED ARRANGE FERRORS		the second state of the se	and a second sec
Denait	Weighter address of			Chantering and a second and a	Uran Carencem Urana	404
	un facer a	and amount sends not	an Anna fan fan an Anna Anna fan ins an	a Constant from second Sciences of	un diale manifesto	e de la companya de la
	Zhont 5 cavita	a solenie	and the second of the second second	 Polision output of the second o	ALL OR OF LOUGH AND	
r ranger.	value s ca ca	Caperor			AllerCales	Addres Centers
Nischiege Lits	DODCH	Order Date	Procedure(s)	Current Delays	Last Vewed By	Provider
Ro	uene	1210018	MIN BRAIN (NO CONTRIAST	Implant needs I ST (18 hours) Pacemaker/CD (19 hours) Zeyed 5 cardiac scenner (16 hours)	Prist	LASTNAME FIRST NAME
50		sangota	MIS BRAIN W.WO CONTRAST	Purgee Team Transport (2 days) Paperit carriet tolerane exam (2 days)	pers	LASTNAME EMISTNAME
TO	Kéné	121.0018	MIR CARDIAC MORPH AND PUNCTION WID CONTRAST	Zayed 5 Landact scanner (2 clays) Screening form needed (8 fourt) Monitored Non-Purple (8 hours)	Peto.	LASTNAME FIRSTNAME
Ro	Lant	100101	MREBRAN WOLDONTRAST.	Screening form needed (2 days) Autoir headed (2 days) Autoir heam needs request (2 days) Purple Team Stansport (2 days) Screening form needs investigation (16 Point)	pod	LASTNAME
80	ultré	1210018	AND BRAIN WO CONTRAST	Purple team needs request (2 days) Purple Team Transport (2 days)	peco.	LASTNAME PRINTNAME
no	None	1212018	MITERARY WO CONTRAND MITA BRAN	Screening form rividid (an hour) Purple team noods request (an hour) Purple Team Transport (an hour)	Prict	LASTNAME
Ro	i, Sine	4210018	WHI BRANCOPP AND TOTAL SPEAK WO	Scheining form needed (an hour) Pacentaken/60 (an hour) Pacentaken/60 (an hour) Purplaintein neede indjuste (an hour) Purpleintein neede indjuste (an hour) Purpleinteinteinteinteinteinteinteinteinteint	Pott	LASTNAME. ERISTNAME



RI is very complicated," said Mueller. "I felt responsible to help minimize delays by identifying areas for improvement."

MRI patients can be delayed for numerous reasons. A typical culprit for delay is incomplete or missing MRI screening forms. Human elements such as claustrophobia also contribute.

While much of the information that leads to delays is captured in the electronic medical record, that information is recorded as free text and therefore hard to quantify and assess what's causing the delay.

Mueller and her team began working with Technology Innovation Center designers and developers to sort out delays. The TIC started by searching for strings of text that became color-coded delay types. Designers and developers then created a data capture system and dashboard for MRI techs to document delay reasons and other information.



We have magnets across the campus. Technologists can use the dashboard filters to sort the list of patients more quickly," said Mueller.

____ 66 _____

In later phases of the dashboard, Mueller says she hopes to get delay feedback to physicians to assist in resolving the delays. The data can be used as a guide to developing an educational tool and to better expedite MRI patients.

MRI DASHBOARD TEAM: Lindsay Wishnies, Dr. Ihab Kamel, Michelle Casler, Samantha Mueller, Kristen Neal

"The goal for the MRI dashboard is to reduce delays, identify trends, and utilize the data to improve patient care and department workflow," said Mueller.

Mueller added that the dashboard exemplifies the success of a collaborative effort; the support of MRI leadership and active engagement with the tool from MRI frontline staff, with technical assistance from the TIC, catalyzes overall improvement in patient care.





FEATURED APPLICATIONS

MS Visualization: Helping Patients See Patterns in their Disease



Multiple Sclerosis (MS), a chronic disease affecting the central nervous system, is highly variable in the way it affects individuals. Collecting data for a large MS patient cohort and then connecting the dots between data and outcomes is difficult; it requires precision medicine.





hen the Multiple Sclerosis Center received a Johns Hopkins Precision Medicine Center of Excellence grant, the center's leader, Dr. Peter Calabresi, Professor of Neurology, asked Dr. Ellen

Mowry, Associate Professor of Neurology, to join the effort of converting numerical data and leading patients to patterns.

"To try to piece together all the data in your head and show that relationally ... it is sort of impossible by just having a table with 700 data points," said Mowry.

Bolstered by the Johns Hopkins Precision Medicine initiative, Mowry, Calabresi, and their team have worked over the past two years to find better ways to collect, align, and display historical and current data for improved monitoring of how interventions and lifestyle influence individual patients.

The Technology Innovation Center worked with Mowry to create the MS Visualization software to assist with this process.

The MS Visualization software shows individual patient data – from prescription medications to relapses, MRI lesions, and MS-specific scores over time, so that clinicians and their patients can look for patterns in their diseases.

"The visualization tool allows us to give back to patients," said Mowry. "We are going to look at what the disease is like and what changes they made that have the largest impact."

Mowry said that a useful feature of the tool for her is to see the overlay of clinical outcomes on top of medications used to treat MS because it is hard to keep the order of events top of mind per patient.



people worldwide," said Mowry.



"I hope it will help people as they come to the clinic have a better understanding of what their course has been like and what changes they made that have the largest impact," said Mowry.

In addition to helping patients see patterns, Mowry said the tool allows her and other clinicians at the center to quickly identify good candidates for clinical trials of new treatments.

She added that one of the best parts of this process is getting to know people and resources at Johns Hopkins that she never knew existed.

One of the things that we've really liked about working with the Precision Medicine effort is that the university has **66** its eye on not only impacting the care of the people at Johns Hopkins, but ultimately improving the care of

Rubicon: Coordinating the Complexities of Pediatric **Sepsis Care**



Dr. Jim Fackler, Associate Professor of Pediatric Anesthesiology, who serves the Johns Hopkins Hospital Pediatric Intensive Care Unit, has been working toward automating clinical sepsis support for almost 25 years.



epsis, often a hospital acquired condition, is a life-threatening response to infection that results in 7,000 child deaths annually.

The Rubicon tool was developed as a comprehensive approach to the early detection, correct diagnosis, and tracking of therapies for treatment of sepsis.

"It puts structure around what had been a chaotic process," said Fackler.

Clinicians can use the tool to preemptively track patients who are at risk for sepsis and leverage established decision support guidelines for those who have been diagnosed. Patients are given labels such as Sepsis Watch, Sepsis Warning, and Sepsis according to their current status.

panegrateters Minimited Margan	
Patient Status Teacter	🚊 259.8 Seein Weiniging
Harr 20, 2017	ann 30,307 🖤
🐨 🕥 sinkh Sipport	
G Seas Cleans	8 terreter and the sector
Constant	Andrewski A
👬 🤷 Harring Sardinar	A
- Osebetlder	Contraction (Contraction)
and the second se	
100 million (100 million)	

Based on the patient's status label, treatment recommendations including antibiotic prescriptions and dosages are made. Care teams are coordinated through a unique patient status timeline and realtime messaging using Team CORUS, a secure clinical messaging platform.







The goal of the tool is to help save the lives of sepsis patients while also dramatically reducing recovery time and disabilities suffered by survivors.

Fackler first came to the Technology Innovation Center in 2017 for the design and development of the solution.

"My first experience with the TIC was with the design team. Bringing my paper sketches to life in the wireframes was step one," said Fackler.

The wireframes were then passed from user experience designers to software developers who developed the solution.

Rubicon will be deployed to the 40-bed Johns Hopkins Hospital PICU unit in spring 2019.

According to Fackler, the most impactful feature of the tool will be the ability to learn what treatments were the most effective.

HealChat: Taking Secure Clinical Communications Beyond Johns Hopkins



The Technology Innovation Center reached a milestone in 2018: it licensed an enterprise-grade software product for commercialization. Heayltics, a healthcare analytics start-up, is taking Team CORUS to market under the name HealChat.



Ρ

eter Chakales, founder of Healytics, first became involved with the TIC through his role as a Mentor-in-Residence at Johns Hopkins Technology Ventures.

"It was one of my first mentoring tasks," said Chakales. "To go down and review the catalog of products to see if there was any commercial viability."

Team CORUS is a secure messaging platform used across all of Johns Hopkins Medicine that keeps patient care teams coordinated. The platform currently averages 6,000 unique users per day and hosts over 120,000 private messaging channels.

Chakales was drawn to Team Corus for its ability to meet HIPAA compliance standards while transferring secure patient health information.

I believe technologies like HealChat are going to be truly instrumental in implementing precision medicine," said Chakales.

Hospitalist physician Dr. Anirudh Sridharan said he believes Team CORUS' vast network of users is what gives the tool its edge over other platforms. Sridharan cares for patients at the Howard County General Hospital who see physicians on other Johns Hopkins medical campuses, leaving him with the question: "How do I get in touch with this provider that I have never met before?"

Physicians like Dr. Sridharan use Team CORUS to look up the name of any clinical staff and start a discussion about care plans of a specific patient. Providers can collaborate across the Johns Hopkins institution with little friction using Team CORUS.

"Without that network of users, you can't get this type of easy communication," says Sridharan.



HEALCHAT TEAM: Ricky Henry, Pete Chakales, Brock Stone, Eric Hebert, (Not pictured: Nat Baylon, Tim Donahoe, Rob Reinhardt) Team CORUS offers flexibility with devices where users receive messages, ultimately driving adoption and standardization. The platform runs on the web and any smartphone. It is also integrated with the hospital's electronic medical record and pager system.



HealChat will ramp up in early 2019, beginning with the Mid-Atlantic and Southeast regions. In the future, Pete Chakales hopes to see broad adoption of the technology, enabling currently disconnected providers to better facilitate the delivery of care.

Active Care:

Increasing Control & Comfort for Men with Prostate Cancer

ESULTS ARE IN: Active Care, R the prostate active surveillance predictive tool, helps patients better understand their cancer risk and perceived control.

Active Care is a software platform that provides predictions to clinicians and their patients in the prostate active surveillance program. Clinicians discuss with patients how their prostate cancer might progress based on historic, demographic, and lab data, which is put through an algorithm to produce outcome predictions.

Dr. H. Ballentine Carter, Director of the Prostate Cancer Program at Johns Hopkins Hospital, designed the application with the Technology Innovation Center and began using it with patients in spring 2017.





I use it virtually every day," said Carter. "It helps me to individualize my follow-up care."

A research team working with Carter studied the effects of using the application with 36 prostate active surveillance patients. Men who were shown predictions from the tool had a 12.8-point increase (scale: 0 to 100) in perceived cancer control compared to men not shown the predictions, who had a 6.3-point increase.

After seeing success with the study, the Technology Innovation Center worked with Carter and his team to improve the algorithm's speed and integrate with clinical workflow by making the tool accessible through the medical record.

"Literally, you're inside a patient's record and you can open it [Active Care] and get all of the information you need," said Carter.

Carter says the tool will continue to be successful in helping Johns Hopkins standardize care and making patients more comfortable by knowing their likelihood of cancer, relieving burden.

EpiWatch:

Bringing Seizure Detection to Consumer Wearables



PIWATCH, the research project that uses the Apple Watch to assist in tracking of seizures and disease management for patients with epilepsy, has a new seizure detection and notification feature, included in the latest release of the Technology Innovation Center-developed app.



Patients in the Johns Hopkins Epilepsy Monitoring Unit are testing seizure detection and helping to improve the software's accuracy for pre-market approval with the FDA.

EpiWatch researchers, Dr. Gregory Krauss and Dr. Nathan Crone, both Professors of Neurology, say this new feature was inspired by Apple Watch's accelerometer and heart rate monitors.

Knowing that the majority of patients have an increase in heart rate during seizures, we wanted to use this technology to help patients detect seizures," said Crone.

Epilepsy patients testing this new feature receive a notification when a seizure is detected and are prompted to either confirm or deny the event. The patients' labeling of a false alarm improves the detection algorithm.

According to Crone, EpiWatch's seizure detector on the Apple Watch now has sensitivity comparable to devices used solely for epilepsy seizure detection. EpiWatch has recorded over 1,000 seizures nationwide.

Accurate seizure detection could change the way epilepsy patients manage their disease, and ultimately save more lives.

We have the ability to engage the patient in a very intimate and immediate way using the unique user interface of the [Apple Watch] and its unique technical specs," said Crone.



じ



BUILDING BEDSIDE

ENTREPRENEURS

he Hexcite (Excited for Healthcare) program is an entrepreneurial early stage medical software accelerator program that draws ideas directly from clinical or hospital administrative spaces at Johns Hopkins. Clinical leads are paired with business, technical, and design leads to design software and businesses with the goal of delivering better patient care.

In 2018, the TIC hosted its fourth Hexcite cohort.

Teams went through 16 weeks of rigorous workshops to conduct 40 customer interviews, design their technology, and prepare to conduct a pilot in the clinical space. They presented their final pitches at Johns Hopkins Digital Health Day.

HEXCITE TEAMS

RUBICON

A software platform that diagnoses, guides, and tracks precision care for hospitalacquired conditions

MY-DOCTOR

A mobile app for patients to review their care teams and deliver real-time feedback

FXAR

An augmented reality application that assists with customized-to-patient training for complex orthopedic surgeries

HERO

An adverse event reporting platform that harnesses natural language processing to aid assessment and behavior change

оторното

A mobile app for parents to quickly assess ear infections using image recognition and machine learning

PRECOG

A platform that guides financial and quality managers through prioritizing review of patient cases with large financial impacts



66 It was educational and thought provoking for sure, and certainly took me out of my comfort zone. In the end, the program helped us focus our thoughts to take what we suspected was a strong idea and envision it as something sustainable and marketable."

David Rini – FxAR, Art as Applied to Medicine





SHAPING SKILLED DATA

STEWARDS

EADS (Leadership in Analytics and Data Science) is a hands-on leadership development program for Johns Hopkins analysts. The program combines technical data science training with data stewardship policy from the Johns Hopkins Medicine Data Trust.

Each LEADS session is led by analytics leadership from across the institution for knowledge sharing that creates community.

DATA TELLS THE STORY:

Based on pre- and postcourse assessments from the initial LEADS cohort in 2017:

.



Participants grew their professional network by an average of 22 members, doubling their contacts in the Data Trust.



.

96% of participants were 'very' or 'extremely' likely to recommend the program to other analysts.



LEADS

C LEADS is a great program that strengthens the organization's analytical workforce by connecting people with different backgrounds and expanding their knowledge base. I attended LEADS' first cohort and felt it was important to give back to the data community by serving as a faculty for its second cohort."

Yury Panfiorau, LEADS Program Faculty



Brainstorm (silently) components (5 minutes)

COLLABORATIVE ASSIGNMENT:

Using de-identified data from 60,000 asthma patients at Johns Hopkins Medicine, LEADS participants were paired in teams and leveraged individual strengths to draw meaningful conclusions about the data. Teams who demonstrate exceptional submissions in data visualization, quality evaluation, and prediction are recognized at the program's closing graduation event.



ENABLING BIOMEDICAL DISCOVERY



In the CAMP program, my team was introduced to the techniques of natural language processing and the experts in data science that can help take our project on pediatric inflammatory bowel disease to the next level."

AMP (Center of Excellence Analytics in С Medicine Program) supports Johns Hopkins clinical research groups interested in leveraging data science to tackle diverse diseases. The program provides a deep dive into the cloudbased Precision Medicine Analytics Platform that combines various data types to help researchers design predictions about a specific disease.

Over the 12-week course, CAMP participants were introduced to data science and machine learning methodologies to interpret their data, while receiving guidance on IRB and grant submissions to move their research forward.

CAMP TEAMS:

Scleroderma*

Myositis* **Pancreatic Cancer***

Arrhythmogenic **Cardiomyopathy***

Bladder Cancer*

Neurofibromatosis*

Ulcerative Colitis Radiation Oncology Spine Surgery Outcomes **Mood Disorders** Venous Thromoembolism



Dr. Steve Miller, Assistant Professor of Pediatric Gastroenterology

- Alcohol-Related Liver Disease
- **Acute Myocardial Infarction**

Bronchiectasis

Ventilator-Associated Pneumonia

Loeys-Dietz Syndrome

Expanding Precision Medicine through Shared Technology & Process



In 2018, the Precision Medicine team, supported by the Technology Innovation Center, scaled the Precision Medicine Centers of Excellence from two to nine. These Centers of Excellence act like internal start-ups, innovating for patients with specific diseases who could benefit from more individualized treatments.

Discovery of more individualized information and treatment is driven by central, secure access to the right data. Delivery of these discoveries occurs through novel software applications and visualizations. As Centers of Excellence grew, the Technology Innovation Center worked toward making discovery and delivery software more widely available.

Featured Precision Medicine Analytics Platform Discovery Tools

Crunchr:



Scientists and researchers can leverage the Johns Hopkins Precision Medicine implementation of SciServer, created by the Institute for Data Intensive

Engineering and Science. Crunchr enables users to cope with scientific big data. It is a platform for ondemand, shareable, scale-able compute and batch iob instances for researchers.

Data Catalog:



The research community will soon be browsing and searching the contents of the precision medicine data commons. In addition to in-depth descriptions, user comments, and categorical tagging on the growing number of data sources included in the commons, the Catalog provides information useful for evaluating the suitability of the content for a user's research purposes.

2018 Precision Medicine Centers of Excellence:



Prostate Cancer:

A cancer that begins in the prostate

GOAL: Determine risk and potential outcomes for patients in deciding when to delay treatments using historical outcomes and

Multiple Sclerosis:

A chronic disease affecting the central nervous system

GOAL: Build a tool that allows providers and patients to see disease progression data in one place and identify patterns using medical record, imaging, and other diagnostic data

5

Scleroderma:

An autoimmune disease that manifests in many different organ systems

GOAL: Study and predict the trajectory of the disease through observations of different organ systems, lung function tests, ECG and cancer progression

8

Arrhythmogenic Right Ventricular Dysplasia/ **Cardiomyopathy:**

A disease where fibrous, fatty tissue replaces the right ventricle of the heart



GOAL: Develop risk calculations for possible sufferers of the condition and recommendations for exercise using imaging, waveform, device, and diagnostic data



demographic data

Myositis:

An autoimmune disease involving inflammation of the muscle tissue

GOAL: Identify characteristics of patients who successfully taper off immunosuppressive therapy using imaging, lung function tests, and

EMR forms

Pancreatic Cancer:

A cancer that begins in the pancreas

GOAL: Discover variables that differentiate long-term survivors and patients who respond well to immunotherapy from patients with worse outcomes using genomic data

3

Neurofibromatosis:

A disease where tumors form in nerve tissue; for 8% of patients those tumors are malignant

GOAL: Identify patients with higher risk of malignancy using genetic markers and imaging data

Bladder Cancer:

A cancer that begins in the bladder



GOAL: Determine how genomic data and autoantibodies correlate with the success of different

therapies

9

Johns Hopkins HealthCare:

GOAL: Build statistical models for patients' health states, expenditures, and enrollment/disenrollment using demographics and claims data



Building a **Digital Health** Ecosystem

JOHNS HOPKINS

DIGITAL HEALTH DAY

The second annual Digital Health Day convened local innovators from the Johns Hopkins and Maryland health tech community to explore resource and collaboration possibilities across disciplines.

366K Twitter Impressions **#JHDIGITALHEALTH18**

ŢŢ

*****=

247 Attendees

32 Resource **Exhibitors**

14 Interactive Workshops



6 **Hexcite Start-Up** Pitches



5 **Co-Organizers**



JOHNS HOPKINS UNIVERSITY lobal mHealth Initiative

JOHNS HOPKINS MALONE CENTER for ENGINEERING in HEALTHCARE





Event attendees were given the choice to attend 3 of the 14 hands-on workshops offered throughout the day with the goal of taking tactical steps toward starting or advancing their own digital health project.



Keynotes

Dwight Raum, Vice President and Chief Technology Officer for Johns Hopkins, opened Digital Health Day by highlighting precision medicine's potential for large-scale impact. Anand Iyer, Chief Strategy Officer for WellDoc, followed-up with digital therapeutics and improving health using patient engagement.





The Resource Showcase featured 32 exhibitors specializing in digital health. Attendees engaged with live telemedicine demos, learned about funding opportunities, and collaborated with local start-ups.

Tallying TIC Impact



In 2018, the TIC scaled its impact to broader networks of people and organizations. TIC staff touched over 100 projects, and tightened process by tracking more hours spent on these projects than ever before. The TIC expanded effort on the institutional Precision Medicine initiative (Johns Hopkins *in*Health) and the associated technology to reach nearly 4000 hours in 2018.

498 people engaged with the TIC:



117 were trained in our programs HEXCITE



134



18,290 hrs

tracked by TIC staff

3,958 hrs

designated toward furthering institutional Precision Medicine efforts



84 Teams

collaborated with the TIC

111 Projects

contributed to by TIC teams



worked with us through projects/other means

Collaborating with Like-Minded Innovators



ADVISORY BOARD

Mark Cochran PhD, MSc Mary Cooke DHA, RN Annette Fries JD Peter Greene MD Stephanie Reel MBA Craig Williams PhD, MA Sanford Wu MIA Christy Wyskiel MBA

JOHNS HOPKINS MEDICINE

Michael Blandino MS Cynthia Boyd MD, MPH Luis Buenaver PhD Rebecca Canino H. Ballentine Carter MD Akhil Chhatre MD Christopher Chute MD, DrPH, MPH Alan Coltri MS Nathan Crone MD James Clark MD Peter Calabresi MD Peg Cooper MBA Maria Cvach DNP, RN, FAAN Kelly Daley PT, MBA Ashwini Davison MD. MS Mark Deise David Efron MD Jim Fackler MD Sherri Flaks Todd Frady MS Michael Gorin MD Ed Grogan MS Diana Gumas MS Kathy Hackett MBA Frank Hoey MS Karen Horton MD Audrey Huang PhD, MA Michael Johnson MD Blake Jones MD Ihab Kamel MD, PhD Eileen Kasda DrPH, MHS Hadi Kharrazi MD, PhD, MSc Gregory Kirk MD Gregory Krauss MD Alain Labrique PhD, MHS, MS Tricia Landis RN Harold Lehmann MD, PhD Howard Levy MD, PhD Steve Libowitz MA

Jim Lustek Steven Miller MD Stephanie Moore Samantha Mueller Greg Osgood MD Ken Pienta MD Stuart Ray MD David Rini MFA Antony Rosen MD Bobbi Schilling **Brandy Schultz Rishab Shah MHS** Kathy Smith MA Lisa Sparks MS Carla Sproge MS Phil Stablein MA Aaron Watkins MA Guy Welty MA Vivian Zhao MHS

Peter Chakales Chris College MBA Nick Culbertson Will Gee Dan Kiselik Mark Komisky JD

Mufaddal Mamawala MBBS, MPH Seth Martin MD, MHS Simon Mathews MD Doug Mogul MD, PhD, MPH Ellen Mowry MD, MCR Jay Pasricha MD, MBBS Christine Robson MSN Cory Sandone MA, CMI, FAMI Matthew Severson MS Orla Sheehan MD, PhD, MSc Zishan Siddiqui MD, MBA Stephen Sisson MD Valerie Smothers MA Kathryn Stamps MHA Anirudh Sridharan MD Charlene Tomaselli MBA Reid Thompson MD Elizabeth Tracey MS Brian Van Winkle MBA Laura Wortman MHA Peter Zandi PhD, MHs, MPH Scott Zeger PhD, MS

BUSINESS COLLABORATORS

Adler Archer JD, MS

Robert Lord Kristian Marquez CFA Marisa MacClary MBA Chris Meenan Sandeep Pulim MD Jennifer Richardson MBA Dan Roche MS Gorkem Sevinc MSE Bob Storey

WHITING SCHOOL OF ENGINEERING

Gregory Hager PhD Vess Vassileva-Clarke MA Peter Searson PhD Alexander Szalay PhD Youseph Yazdi PhD, MS, MBA

JOHNS HOPKINS TECHNOLOGY VENTURES

Jorge Aquino MBA, MS Liz Burger MPA Mark Maloney MS, JD Brian Stansky MS Nina Urban MS, MBA Mark VanderZyl Megan Wahler Seth Zonies PhD

CAREY BUSINESS SCHOOL

Mike Doyle MEd Ali Godfrey MBA Sharon Kim PhD Mary Somers MS Roger Williams MEd, MPA

APPLIED PHYSICS LABORATORY

Brant Chee PhD, MS Adam Cohen Jordan Matelsky Michael McShea MBA, MS Geoffrey Osier MS Alan Ravitz PhD, MS Corban Rivera PhD

TEDCO

Moss Amer Anne Balduzzi Neil Davis MBA John Gustin PhD Jennifer Hammaker

Anatomy of a Technology Innovation **Center:**

Understanding how the Technology Innovation Center functions requires a closer look. The TIC anatomy sustains its people, environment, activity, value, and success.





People Powered

- Developers
- Designers
- Project Managers
- Data Analysts

Scaling to Success

- Technology Lifecycle Management
- IT Organization Integration
- Business-Based Sustainability
- Software as Building Blocks

Environment **Enticing Action**

- Caffeine
- White Board Walls
- Online Team Chat
- Proximity to Hospital

Augmenting Activity

- Leadership Training
- Digital Health Day
- Co-Development & Collaborations
- Facilitating Connections

Validating Value

- Advisory Board
- Iterative Development
- User-Centered Testing & Feedback
- Impact Assessed at Patient Level



Johns Hopkins Medicine Technology Innovation Center

855 North Wolfe Street, Suite 600-B Sixth Floor, John G. Rangos Building Baltimore, MD 21205



tic.jh.edu



tic@jhmi.edu



@JHMTIC



facebook.com/JHMTIC