RTHM
Real Time Health Mapping

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Revolutionizing chronic disease treatment by understanding personal environment.

www.realtimehealthmapping.com

"Everything about this neighborhood,... it all makes you sick. Don't get me wrong, we love this place, we love Spanish Harlem. But it does stuff to us. Now it's giving us all diabetes." [1]

Mr. Concepcion, diabetic, 2006

What is RTHM

RTHM is a micro application with macro impact on chronic disease treatment.
By situating each patient in his or her specific socio-spatial environment, RTHM enables doctors to prescribe data-driven, neighborhood informed, environmental directives for improving compliance in chronic disease treatment.

Problem

Chronic disease is a growing worldwide problem. Lifestyle change is well accepted as a treatment and prevention, but lifestyle is hard to define, and even more difficult to change. Lifestyle is highly personal, complex, and often too abstract to be positively influenced, especially from the level of general health policies.

Approach

Our approach is therefore not only bottom up or top down - it is personal.
We believe that the way each of us live is deeply connected to the place where we live and how we interact with our environment. RTHM defines and systematically visualizes lifestyle as a set of personal spatial practices.

Focus

RTHM is a tool for doctors with the focus on each patient. Through RTHM, a patient isn't a health statistic, but is a key partner in creating and maintaining a positive, health-based, social network. This network is situated within the single neighborhood, building on personal interactions and shared spatial practices to provide easier behavioral treatment.

Innovation

The RTHM Harvard Team has developed environmental health parametric technology.
Our technology renders a patient's health performance map by positioning personal health parameters within a network of neighborhood social and environmental parameters.

Benefits

By revealing, mapping, and personalizing health care resources outside of clinics, RTHM enables use of existing healthy resources in each patient's personal environment - significantly reducing overall healthcare resource consumption.

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[1] N. R. Kleinfield. "Living at an Epicenter of Diabetes, Defiance and Despair." The New York Times. 10 Jan. 2006 <http://www.nytimes.com/2006/01/10/nyregion/nyregionspecial5/10diabetes.html?pagewanted=print>

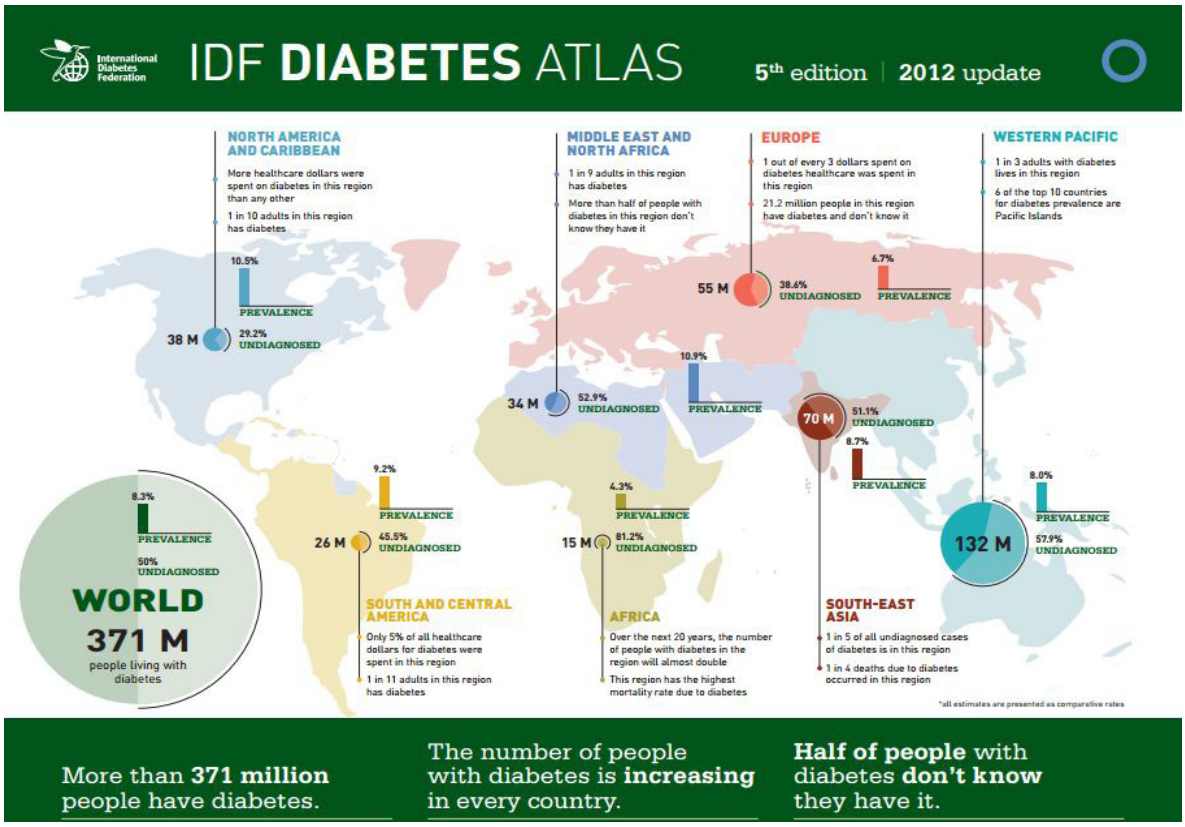
The growing global chronic disease environment

Diabetes is one of the most widespread and lifestyle effected chronic diseases. 371 million people currently suffer from diabetes , 80% of whom live in low or middle-income countries.[2] Global expenditure to treat chronic disease is projected to be $47 trillion by 2030 according to World Economic Forum.[3] In the US alone, the cost of treating chronic diseases such as diabetes is close to $1.5 trillion annually (CMS), most of which is wasted in treating symptoms of a deeply systemic problem.[4]

Recent studies demonstrate that chronic disease is most effectively treated through social support, diet, and exercise. The critical Look AHEAD study (2001-2014) shows that lifestyle change is the determining factor to reverse the symptoms of diabetes.[5] Community oriented programs such as project DULCE (2010) also established strong precedent's for specially tailored treatment programs.[6]

However, lifestyle change is difficult for individuals to visualize. Social and environmental qualities of neighborhoods make high-chronic-disease-risk lifestyles appear the norm for many communities.

In the medical system, the treatment paradigm is still mainly unidirectional, causing costs to spiral out of control without correlated improvements in care. Pharmaceutical treatment and surgery are risky and expensive. Although lifestyle change is routinely advocated by doctors, non-compliance and re-admission is high. 75% of total healthcare costs in the US are due to chronic disease. Chronic diseases such as type 2 diabetes and heart disease come at a huge cost to patients, payers, and providers.



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[2] 2012 update Global Diabetes Atlas, International Diabetes Federation, http://www.idf.org/diabetesatlas/5e/Update2012

[3] Bloom, D.E., Cafiero, E.T., Jané-Llopis, E., Abrahams-Gessel, S., Bloom, L.R., Fathima, S., Feigl, A.B., Gaziano, T., Mowafi, M., Pandya, A., Prettner, K., Rosenberg, L., Seligman, B., Stein, A.Z., & Weinstein, C. (2011).The Global Economic Burden of Noncommunicable Diseases. Geneva: World Economic Forum

[4] http://cms.gov/

[5] L. Maria Belalcazar, Md, David M. Reboussin, Phd, Steven M. Haffner, Md, Ron C. Hoogeveen, Phd, Andrea M. Kriska, Phd, Dawn C. Schwenke, Phd, Russell P. Tracy, Phd, F. Xavier Pi-Sunyer, Md, Christie M. Ballantyne, Md. A 1-Year Lifestyle Intervention For Weight Loss In Individuals With Type 2 Diabetes Reduces High C-Reactive Protein Levels And Identifies Metabolic Predictors Of Change. Diabetes Care, Volume 33, Number 11, November 2010

[6] Athena Philis-Tsimikas, Md, Chris Walker, Mph, Lisa Rivard, Rn/Cde, Gregory Talavera, Md, Mph, Joachim O.F. Reimann, Phd, Michelle Salmon, Mph, Rachel. Improvement In Diabetes Care Of Underinsured Patients Enrolled In Project Dulce. Diabetes Care, Volume 27, Number 1, January 2004

The US Federal Affordable Care Act directs $15 billion to tackle inefficiencies of disease treatment by linking hospitals, insurance companies, and community agencies. The Affordable Care Act especially promotes evidence-based innovative approaches based on technology trends and social engagement. This builds on the 2009 Health Information Technology for Economic and Clinical Health (HITECH) Act which earmarked over $ 25 billion dollars to promote and expand the adoption of health information technology.

These national policies have stimulated many innovations in the use of geospatial information systems for visualizing and analyzing dynamics correlating health and environment. However, health-mapping projects mainly take purely top-down approaches, geo-locating health statistics on a local or state level.

These approaches have failed to address the specificity of personal health condition and failed to provide resources for necessary behavioral changes. Bottom-up approaches used by many community groups, on the other hand, often address and map specific neighborhood-based issues and health resources but are not often considered evidence-based.

RTHM approach answers the needs of new policies

Real Time Health Mapping aims to deal with the social complexity of chronic disease issues, providing the technology that meets the federal government's National Prevention Strategy: "Working together to improve the health and quality of life for individuals, families, and communities by moving the nation from a focus on sickness and disease to one based on prevention and wellness. "

RTHM unite's the Strategy's four strategic directions:

> Healthy and Safe Community Environments: Create, sustain, and recognize communities that promote health and wellness through prevention.
RTHM systematically maps and analyses places where we live, work, learn and play in terms of our wellness. By visualizing healthy resources in our personal surroundings, RTHM makes "healthy choices easy and affordable for each patient."

> Clinical and Community Preventive Services: Ensure that prevention-focused health care and community prevention efforts are available, integrated, and mutually reinforcing.
RTHM provides a simple framework for integrating community prevention programs with clinical treatment. Electronic health records are put to work to lower costs and improve care by plugging patients into evidence-based social and environmental networks.

> Empowered People: Support people in making healthier choices.
RTHM is a mapping tool that provides a way of seeing healthier options in our personal environment. This new health-based environmental information, clearly visualized and accessible to patient and community, is a roadmap to "promote positive social interactions and support healthy decision making." By testing community change with electronic medical records, RTHM provides the evidence base to engage and empower people and communities to exercise change.

> Elimination of Health Disparities: Eliminate disparities, improving the quality of life for all Americans
By merging social, spatial, and health data on the neighborhood level, RTHM aims to identify and map high-need areas that experience poor health outcomes. Through local health providers, the application generates personal environmental prescriptions to each patient by rendering aggregate health-based environmental data in order to recognize and align existing spatial resources with community needs. RTHM becomes a tool for developing and evaluating community-based interventions that improve health outcomes and reduce health disparities.

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[7] Bill Davenhall, Your Health Depends, http://www.youtube.com/watch?v=62cNtvx6P8E
[8] Our Healthy Massachusetts, http://ourhealthymass.org/
[9] National Prevention Strategy, http://www.surgeongeneral.gov/initiatives/prevention/strategy/index.html

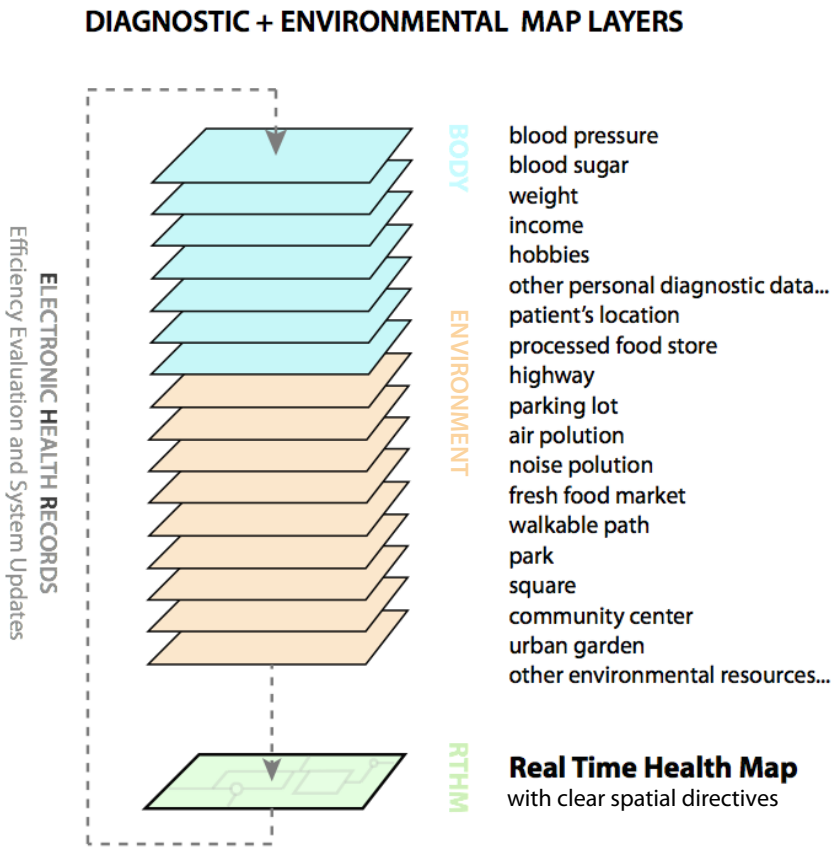
Innovative technology: Environmental Health Parametrics

As doctors are trained to read how personal health changes under different circumstances, urbanists are trained in mapping and understanding complex parametric qualities unique to neighborhoods.[10] Mapping material and immaterial urban phenomena tells a great deal about neighborhood socio-spatial flows and patterns. With recent developments in electronic health records, personal health data can finally be spatialized in real time. This process becomes a way to test personal neighborhood health diagnoses.

RTHM positions the patient's personal health data within the context of one's neighborhood data. Personal health data such as blood pressure, blood sugar, weight, and contextual data like income or even personal hobbies, are overlaid with environmental-based data such as patient's geo-location, neighborhood vacant lots, parking lots, nearby highways, sidewalks, parks, squares, processed food stores, air pollution, fresh food markets, exercise facilities, urban gardens, community centers, pharmacies, schools, liquor stores, brownfields, and many other parameters important to a specific neighborhood.

Both parameter types are treated as diagnostic layers and are algorithmically merged with parametric design software. Parametric design has been developed as the most progressive technology in contemporary architectural and landscape analysis and design, but has never been used for understanding personal health dynamics in space.

Emerging from the parametric fusion of human body and human environment, our new technology is called environmental health parametrics.



[10] Richard Forman (Land Mosaics, 1995), Niall Kirkwood (Brownfield Regeneration, 2010), Charles Waldheim (Landscape Urbanism, 2006), Anita Berrizbeitia (Inside/Outside, 1999), Alan Berger (Drosscape, 2007), Ian McHarg (Design with Nature, 1969), Randy Hester (Ecological Democracy, 2010), Jack Dangermond (Geographic Information Systems, 1969), and Lawrence Halprin (RSVP Cycles, 1969) along with many others have long aimed at making accurate hypotheses about urban phenomena in past, present, and future.

The final product of this technology is twofold:

1. A visual interface for doctors and hospitals that overlays body and environmental health parameters of each patient. Algorithmic overlapping produces a single map through which doctors can have a complete overview and understanding of patient's specific health condition in his or her environmental context, making neighborhood data accessible. This interface provides a map of neighborhood environmental health dynamics on personal (single patient) and aggregate level (all patients from a particular provider in a neighborhood). This completely new way of understanding personal and public health dynamics is a tool for doctors to revolutionize medical practice and stimulate improvement of general health care policies.

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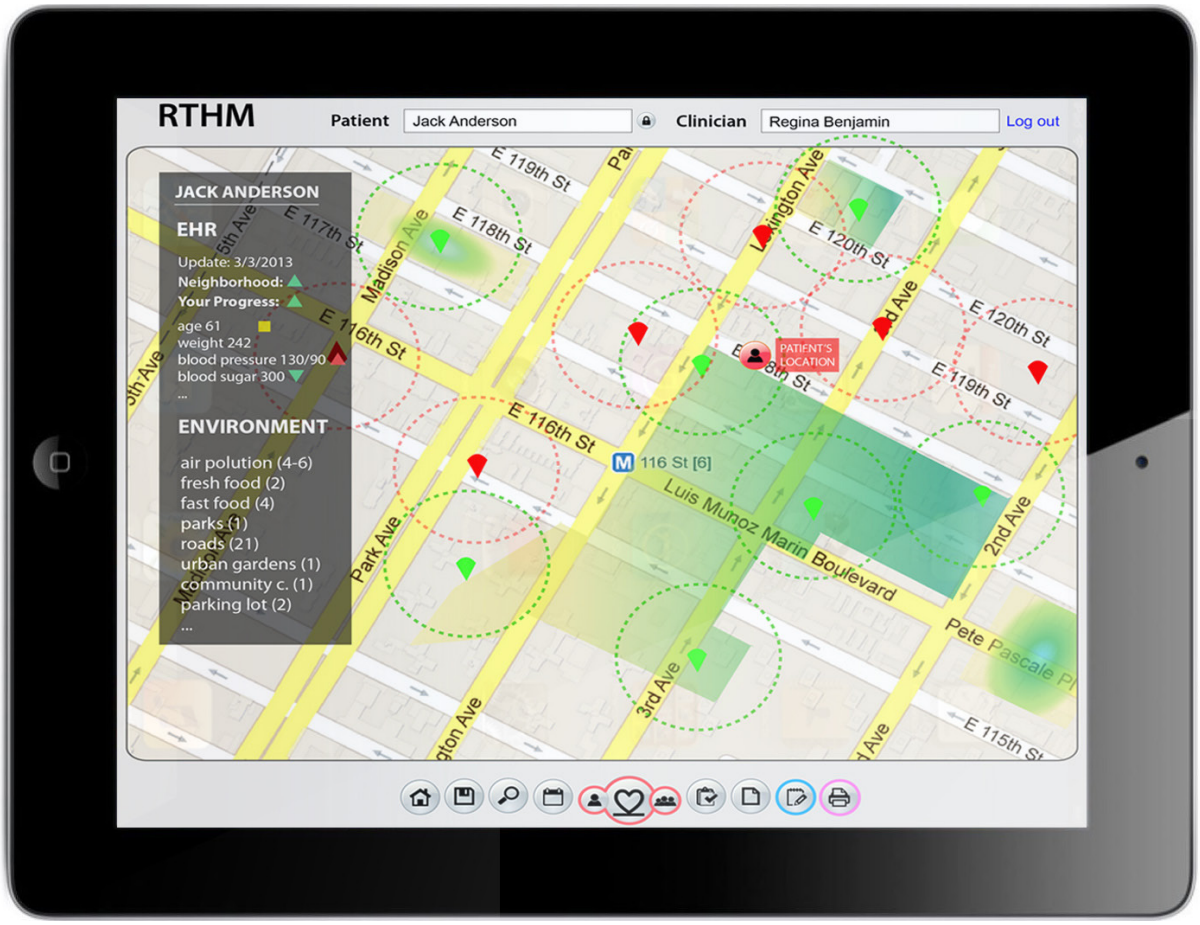

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detailed EHR | give a medical perscription | render an environmental prescription | print a prescription

2. A personal health map for patients is rendered and given to each patient as a set of visual directions, not just a daily set of exercise routes, but also paths of different everyday navigation through a patient's neighborhood [RTHM]. The doctor is able to print these personalized routes, complete with specific resources and community events, providing information about how many patients use the same health resources in the same neighborhood. The personal health map will clearly visualize patient's personal health dynamics and compare it to general neighborhood trends [EHR]. While doctors have full (and private) overview of specific neighborhood health dynamics on the personal and aggregate level, patients are able to hold a personalized health map of their own neighborhood. This map is available digitally or printed, and is accessible for all patients.

Illustrative story:

“Mr. Anderson, please, you are going to have to change your diet and exercise... You can deal with diabetes. You can reverse symptoms. I’ve given you a long list of parks where you can exercise and a long list of community gardens. Have you tried those stores that sell fresh food? They are in your neighborhood right?”

Jack Anderson shook his head, “It doesnt work, Doctor. I checked some of those places - the ‘gardens’ were abandoned - the vegetables were mildewed - the parks were full of rough kids.”

“Listen, Mr. Anderson, we are trying a new method, just starting today: it is called RTHM, like ‘rhythm.’ Rhythm plugs your health data into a constantly changing stream of information about the neighborhood.” She showed him his Real Time Health Map on the screen.

“That area is generally, safer, I heard. Hmm...but I have never been there before.”

The doctor printed a map for the next week.

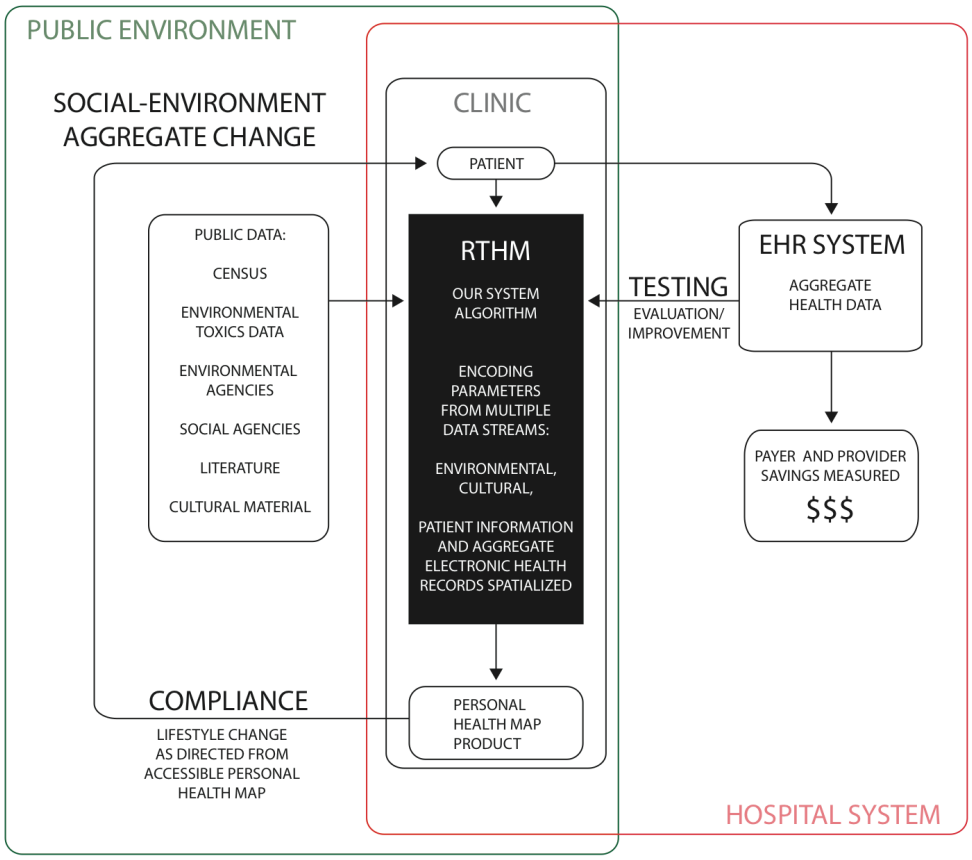
Jack tried the map, and found that, generally, the parks and streets it recommended were easier - they were places where other people were walking, where other people like him actually buy fruits and vegetables. He even had a conversation with some of them.

Over the next few months, the maps lead to even more vibrant places. Dr. Benjamin explained to Jack Anderson one day:

“Mr. Anderson, the maps get better. The system builds on the rhythm of the neighborhood to judge places where people are successfully changing lifestyle. Mr. Anderson, all those tests we do in the clinic - all that goes into that rhythm - that’s how it works.

Implementation: RTHM - Micro Tool for Macro Impact

Where the existing health care system leaves loose ends, RTHM ties these together, for streamlined quality oriented, low cost, care.



RTHM is personal, built from each patient's personal real-time data stream integrated within parameters of the patient's personal neighborhood environment. In this way, it is constructed from resources recognizable to the patient.

RTHM is an evidence-based tool: all diagnoses are tested through aggregate statistical change in the hospital's existing Electronic Health System (EHR). As evidence is gathered, the environmental health algorithm is improved and more effective fields are offered to aid in treatment compliance.
Even neighborhoods with multiple hospitals share social and environmental parameters. In this way, as RTHM builds its environmental health parametrics, diverse hospitals become beneficiaries and potential partners.

Knowledge about aggregate progress is crucial not just for hospitals and new health policies, but also for patients. Patients can clearly position their own health progress within broader community health dynamics. Operationalized, this knowledge also generates health-based community networks, safety corridors, and empowering social capital. With RTHM, chronic disease is not just a personal burden, but a common and shared flow of change, and therefore can be managed through collective action.

By merging up to date behavioral economics knowledge, public health expertise, and contemporary design technology, RTHM aims to become a micro tool with macro impacts for patients, neighborhoods, physicians and hospitals.

PATIENT BENEFITS: Changing lifestyle through directive maps

RTHM provides a personal health map to spatialize lifestyle change and prescription compliance in an accessible, localized, and meaningful way. It is a simple, comprehensive, graphic visualization of the neighborhood context with all agencies and opportunities for compliance performance. For lifestyle change, potential health resources such as squares, parks, fresh food markets, community gardens, health organizations and events are visualized and linked into routes according to patient's location and its specific health condition. **Our health is out there.**

NEIGHBORHOOD BENEFITS: Changing lifestyle through social networking

RTHM positions and visualizes personal disease within a broader socio-spatial context, demonstrating that the patient is not the only one with the specific health problem. Through RTHM, each patient is able to externalize his or her own disease by transforming "my own problem" into "our problem to solve together." Visualized and specialized on an aggregate level, health data creates a health-based social network that stimulates and sustains transformation of habits in the specific local setting. **We are our health.**

PHYSICIAN BENEFITS: Reducing re-admissions through the RTHM evidence-based health-improving system

Linked with the Electronic Health Records, RHTM extracts necessary data for each personal health map, evaluating its own functional efficiency and continuously upgrading according to specific patient needs. Along with more efficient treatment compliance, RHTM will help physicians to exercise their full agency to address each patient's specific health context. **Help me help you.**

HOSPITAL BENEFITS: Reducing overall healthcare cost by strategic usage of the environmental health resources

Linking personal health with community infrastructure allows hospitals to find treatment solutions in each patient's socio-spatial environment, reducing re-admissions and lowering overall provider costs. Health-based social capital created through the RTHM system is translated into significant financial benefits for both patients and hospitals. **A healthy environment will save us all money.**

RTHM in action – pilot programs, funding, scaling

In order to test our innovation, we have to reach a key number of hospitals and work with specific communities. Right now we are intensively communicating with medical professionals and nine communities around the US, aiming to develop site-specific RTHM pilot studies.

Only through pilot programs can RTHM assess the particular community triggers needed to stimulate positive behavior change. Establishing appropriate visual communication in each culturally unique neighborhood is a question that needs to be resolved through RTHM's pilot programs. As the use of electronic health records continues to develop in a diversity of medical settings, RTHM must adapt to the needs of particular hospitals and clinics. This too, must progress naturally through pilot programs.

RTHM technology presents an innovative understanding of new environmental insights through a collaborative tool for increasing quality of care at a lower cost. These insights must emerge from in-depth research into parameters unique to specific communities and develop through interaction between, patients, agencies, and medical professionals.

Technology alone cannot solve chronic disease with the push of a button – **RTHM needs your help.**