

information ecosystems for well-being:

new tools, new connections, new identities

Information creates the flows in our ecosystems of well-being. It connects medical practice, public health, and the private rituals of daily life in a thickly layered environment of personal choice and constraints. Out of these flows, we form the narratives that resolve medical mysteries, inspire healthy behaviors, and even give meaning to our lives.

But information flows can also overwhelm. They can flood our ecosystems with noise that undermines our well-being. And over the next decade, new technologies, proffered by new players, will open the flood gates. Biosensors, swarms of drones, Internet-connected appliances, and even retail transactions will generate unprecedented flows of data. By 2022, the volume of digital information will scale so rapidly that we may lose the flow. The important stories embedded in our fragmented data may barely inform the reality of our lives.

In freshly disturbed biological ecosystems, pioneer species create nutrients for other organisms. In information ecosystems for well-being, innovators are like these ecological pioneers. They make data and information more usable as resources to support well-being. They create pathways that reconnect the flows, who reshape the powerful streams of data into actionable resources for health and well-being. They will **automate** these streams and use them predictively to bring the right story to the right person at the right time. But they will also **amplify** our human roles and relationships to make us all partners in the project of being well. Ultimately, they will provide **high-resolution views** of who we are and what it means to be healthy and happy.



INSTITUTE FOR THE FUTURE

124 University Avenue, 2nd Floor
Palo Alto, CA 94301
650.854.6322 www.iff.org



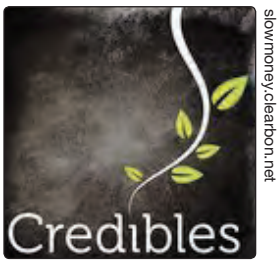
hotspot forecasts
for information ecosystems for well-being

automated/predictive systems

1 VALUING FUTURE HEALTH reframing upstream interventions as investments

Big data will improve understanding of the value of upstream health interventions and reframe them as investments in future health and health capital. This will drive social impact investing as a way to generate a return by funding up-front interventions that lead to later savings through reduced hospitalizations and improved outcomes.

Table with 3 columns: SHORT-TERM, MEDIUM-TERM, LONG-TERM. Content describes health care system experiments, community financing strategies, and clinical/community efforts.



Slow Money's Credibles project microfinances healthy food.

slowmoney/carbon.net

2 DISTRIBUTED HEALTH POLICING automating surveillance for participatory public health

Powerful automated surveillance tools will become available to consumers, opening new frontiers in policing individual and institutional actions. Citizens will use drones to monitor and maintain healthy environments, while other initiatives will look to increasingly distributed forms of intelligence gathering and policing to anticipate perceived health threats and prevent outbreaks.

Smart phones and other lightweight devices allow citizens to report and map health and public safety hazards in real time. As sensors decline in cost, they will increasingly be integrated into everyday products and environments, allowing individuals and networks to monitor and police local environments for perceived threats to community health. Citizen groups and activists will use drones to protect local spaces such as watersheds and to police the environmental health impacts of large-scale institutions.



Asthmapolis allows citizens to report and map asthma outbreaks using sensors attached to inhalers.

asthmapolis.com

3 AWARE AND RESPONSIVE SYSTEMS engineering dynamic clinical information systems

With accountable care influencing how reimbursement is structured, more health care providers will adopt smart, automated systems to notify patients of results and follow up with them. These systems will also integrate data from clinics, pharmacies, and smart devices, helping doctors screen, diagnose, and monitor patient conditions.

Integrating automated alerts into electronic health records will improve patient safety and overall health by seamlessly supporting providers' decision-making processes. Streams of data collected by smart devices will be integrated with clinical information to give health professionals a more holistic view of patients. Though not panaceas, clinical information systems that are transparent, accessible, and responsive will be considered essential building blocks for evidence-based clinical practices.



Ingestible microchips on "smart pills" will monitor bodily functions and transmit data.

profashioned.com

4 PERSUASIVE PROFILES personalizing behavior change

Massive data analytics will enable the creation of comprehensive health and well-being profiles of individuals. These profiles will be used in conjunction with real-time identification tools, such as facial recognition technology, to persuade us to make health-related decisions in both medical and retail contexts.

Retailers will tailor advertising in the aisle using facial recognition, alienating some, but earning long-term loyalty with many customers by steering them to healthy goods. Personal and family health goals will be integrated into medical records, leading to increasingly personalized care initiatives. As back-end information systems streamline data sharing, different profiles—including purchase records, medical histories, and well-being goals—will converge, enabling customized and diverse interventions.



Target has developed a pregnancy score that can identify pregnant customers during their second trimester.

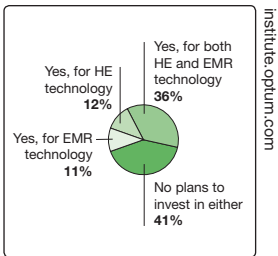
automated/predictive systems

amplified roles/interactions

5 DESIGNED INTERFACES making systems data and communications meaningful

As clinical health data leaves file cabinets and mainframe computers and enters the cloud, information designers and data experts will present medical data in a more actionable and meaningful way. Industries with experience maintaining secure and effective interfaces will help us manage health finances and use clinical data to improve health outcomes.

Players from large financial institutions to small start-ups will offer tools for aggregating personal and clinical health information, increasing transparency around cost, quality, and outcomes. Clear and multi-sensory data interfaces will make it possible to organize health data around the person, rather than only the history of procedures and billing codes. Interested parties will rent, sell, trade, or donate health data in exchange for money, discounted goods or services, or the advancement of medical research.



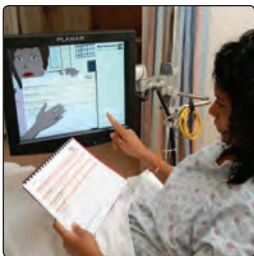
Most hospitals plan to invest in cloud-based technology for medical records.

instituteoptum.com

6 PROGRAMMABLE SELF-CARE prescribing therapeutic information streams

Personal health informatics—the collection, integration, analysis, and control of personally relevant health data—will become a major preoccupation of daily life. New service providers, technologies, and strategies will emerge to help us manage these massive information flows and leverage them for self-care.

Self-monitoring will move into the mainstream as sensors, devices and apps automate tracking of personal health data and raise self-awareness to support well-being. Information prescriptions—automated ambient changes to lighting and sound in the environment—will influence choices in a stress-free, nearly invisible way. Individuals will be able to program their health information streams, as well as health bots, to fit personal well-being and information-engagement preferences.



Project RED at Boston University uses a virtual person to provide health information to patients.

relationagents.com

7 MICROWORK FOR WELL-BEING distributing lightweight health and medical tasks to a flexible workforce

Public health and safety agencies, communities, and businesses will leverage mobile technology to distribute small health tasks to people all over the world. Microworkers will contribute to gathering data, caring for the built environment, and assisting with emergency services, elder care, and health care system navigation.

Expanded understandings of the determinants of health will drive the emergence of new kinds of health microwork. New players will offer microwork certifications, licensing, and skills training. Microwork will succeed as a development strategy in many countries, providing opportunities to paraskilled workers performing tasks, such as X-ray analysis, that can be conducted remotely. In some countries microwork will transform the employment landscape, with many workers on call for different tasks. In other countries, microwork will remain supplemental.



TaskRabbit certifies microworkers who bid on small tasks, many health-related.

taskrabbit.com

8 QUANTIFIED STORYTELLING artfully communicating health data to lend relevance

As data becomes more abundant and overwhelming, artful storytelling will be increasingly important to well-being. Culturally agile storytellers will find new roles in the health landscape, and public health organizations will rely on artists of all kinds to keep their messages relevant.

The need for reduced costs will lead to a new class of medical paraprofessionals such as health coaches, who provide decision support in non-clinical settings, such as schools and churches. We'll see personal and community health sensemakers, who use storytelling to make complex health data understandable and therapeutic, emerge as a role in the health world. Individuals deliberately create and co-create their own health narratives as a well-being strategy, as well as "storytelling profiles" to keep communication preferences constant across contexts.



Jerry the Bear uses stories to teach children about diabetes management.

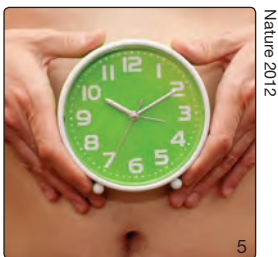
amplified roles/interactions

high-resolution views/interventions

9 TIME-TARGETED INTERVENTIONS designing optimized routines and treatments to rebalance minds and bodies

Chronobiology research reveals that we have different optimal times for everything from sleep, work, and exercise to receiving medical treatment. Understanding precise timing will play a key role in health treatment regimens, as well as in optimizing schedules in schools and workplaces to enhance health and well-being.

We will seek to maximize the benefits of health practices, such as taking medications and eating certain foods, by timing them better. Animal research leads to the emergence of drugs and clinical treatments that work by altering our internal sense of time. Organizations will develop strategies to limit negative health impacts on shift workers, nurses, and emergency personnel, reinventing processes to align with biorhythms.



Hormones linked to metabolic timing could lead to new drugs.

Nature 2012

10 AFFECTIVE HEALTH SENSING augmenting emotional intelligence through wearable computing

New ways to sense and convey human emotions by measuring physiological states will transform how we communicate with machines and each other. Ubiquitous biofeedback sensors and displays will enhance empathy and emotional regulation. This capability will inspire novel services to support mental health, collective well-being, and productivity.

Affective health applications will drive innovations across the health care, entertainment, and mobile technology industries—identifying vulnerabilities and empowering telehealth specialists. We will cooperate and share affective data and experiences to find better ways to interpret information from our numerous wearable health-tracking devices. In a world of sustainable, responsive architecture, the buildings we inhabit and the transportation we use will augment our physical and emotional health skills.



Affective Health's mobile app displays people's emotional responses to daily events.

www.sics.asch

11 TRACKING MULTISPECIES CONNECTIONS adapting to climate challenges through planetary monitoring

Scientists are exploring how organisms adapt to volatility at macroscopic and microscopic scales. The simulations and high-resolution views of biodiversity they are building will fundamentally reshape global health practices. Multispecies analysis will be used to improve habitats, enhance food safety, and boost human immune responses while nourishing the ecosystem.

Scientists and citizens will learn resilience from studying the behaviors of aquatic and terrestrial plants and animals as they acclimatize to environmental stressors and changes. Our ecological literacy will improve as we develop greater public participation in stewarding the value of biodiversity and its role in human health. Insights from other cultures and species will demonstrate how we can cope with disasters, and make use of seasonal resources flexibly and appropriately, as nomads and migratory animals do.



The Geo-Cosmos exhibit makes multilayered views of the biosphere public and accessible.

ibateethnes.co.jp

12 OPTIMIZING MICROBIAL DIVERSITY stewarding bacterial ecosystems to support individuals and institutions

Research into the human microbiome highlights the critical role bacterial ecosystems play in natural human well-being and health outcomes. This understanding will drive new methods of managing, rather than eliminating, the bacteria in our bodies, foods, and environments, and conserving antibiotics for where they are needed most.

Efforts to enhance our bacterial ecosystems will move from probiotic consumer products into traditional medical practice as health-promoting bacteria become a strategic health intervention. Architects and building designers will experiment with designing living systems of bacterial diversity into our physical spaces, much like strategically placed plants. Just as biodiversity has become a strategic environmental asset, exposure to microbial diversity will come to be seen as a strategy for building health capital.



Philips "microbial home" aims for ecosystem balance in the home.

high-resolution views/interventions

new opportunities to support well-being in the many settings of everyday life

Across the basic settings of everyday life, from home and work to clinics and shops and everywhere in between, new information ecosystems will create opportunities to support well-being in new ways—making new information flows truly actionable.

hotspots ▾	settings ▸				
 automated and predictive systems	 home	 work	 clinical	 retail	 on-the-go
	Create dynamic communications to reach the diverse and coexisting preferences of different people living in the same home	Use sensing technology to understand and anticipate employees' true physical and emotional health states, but be mindful of the potential to violate privacy and create an oppressive atmosphere	Develop capabilities in pattern mining to anticipate community health needs and partner with community efforts to build networked prevention and intervention strategies	Build responsive communication channels and interoperable systems between retail medicine and clinical medicine to reduce the information work for the consumer	Create information tools that offer seamless continuity in different settings, both in the real and virtual worlds, and align with personal patterns of mobility
	Use microwork platforms to crowdsource home care and assisted living tasks	Sponsor platforms and allocate time for employees to engage in micro-contributions to support each other's well-being, such as donations of paid time off, vacation, and care	Invest in clinical data systems that use lightweight technology and can easily be upgraded and adapted to multiple operating systems, devices, and user experiences.	Remake the shopping experience into a learning experience by deploying health coaches in physical and virtual retail settings to help customers individually tailor well-being and diet regimens	Create participatory platforms to allow people to use the personal, community, and environmental data they capture for public health in transparent and respectful ways
 amplified roles and interactions					
 high-resolution views and interventions	Connect high-resolution understanding of the body and the larger environment to change the way people design health into their homes and communities	Be sensitive to individuals' biological rhythms and the needs that accompany them, particularly those whose well-being and health depend on time-targeted therapies	Use new evidence of the harmful effects caused by changes to the microbial environment and multispecies ecosystem to anticipate new supply chain and facilities management challenges	Prepare for higher scrutiny as citizens gain a deeper understanding of the health effects of waste management and sourcing practices and increasingly gain the ability to monitor them	Use ambient information and multisensory interfaces in public spaces to shape health behaviors without creating stress and anxiety

To further explore how people will use information to create well-being in the settings of everyday life, look for Health Horizons' Information Ecosystems of Well-being toolkit this fall. It will describe personas of leading edge health pioneers, the emerging strategies they will use to make information actionable, and the changing settings of everyday life they will navigate. Together with this map, it provides a set of tools for thinking systematically about how to use abundant data to enhance health and well-being.



For references, please scan the QR code




a guide to the future

information ecosystems for well-being



This map is a guide to our rapidly changing information ecosystems for well-being. You can use it to explore the three hotspots of innovation and well-being and the opportunities for new products, services, policies, and strategies in a variety of settings for the pursuit of health and well-being. Within each hotspot are forecasts that identify innovations and disruptions that will make health information actionable.

Innovation hotspots

-  **automated and predictive systems** Data mining and analytics will fuel efforts to create information systems that can anticipate problems for health and healthcare—and intervene automatically.
-  **amplified roles and interactions** Abundant data and the new interventions it brings will change the way people connect with ideas, information, organizations, and with one another, amplifying the power of information to create new meanings of well-being.
-  **high-resolution views and interventions** The ability to see patterns and phenomena at new scales from the smallest to the greatest will change the way we thrive as complex living organisms.

Forecasts and signals

This map contains 12 forecasts of innovations and disruptions that respond to the challenge of making information actionable for well-being. Each forecast is accompanied by one or two signals. These are examples from today's world that point to the future depicted in the forecast.

The opportunities for novel solutions

The innovation hotspots will also create big opportunities for pioneers across our economies and communities. Jump-start your own future by anticipating these opportunities in the many settings where we will create well-being in new ways over the next decade, from clinical and retail settings to work and home and even on the go.

ABOUT IFTF | We are an independent, nonprofit strategic research group with more than 40 years of forecasting experience. We offer clients a deep understanding of the identifying trends and discontinuities that will reshape well-being and health in the next then years.

ACKNOWLEDGEMENTS

Authors: Miriam Lueck Avery, Brinda Dalal, Rod Falcon, Ben Hamamoto, Bradley Kreit, Rachel Maguire

Peer Reviewers: Mary Cain, Tracey Grose, Mike Liebhold, Jason Tester, Kathi Vian

Editors: Lorraine Anderson, Pete Shanks

Producer and Creative Director: Jean Hagan

Design and Production: Robin Bogott, Karin Lubeck, Jody Radzik, Robin Weiss

In memory of Vivian Distler



© 2012 Institute for the Future. All rights reserved. All brands and trademarks remain property of their respective owners. Reproduction is prohibited without written consent. SR-1499