

TECHNOLOGY CATALYSTS

for human and
economic vitality 2030



INSTITUTE FOR THE FUTURE

In the next decade, we have the opportunity to create a culture of health, transforming the art and science of health promotion and chronic disease prevention by strategically engaging with technology.

Transparent views into healthcare costs—along with new understanding of the relationships between well-being, productivity, and habits—contribute to growing evidence that assuring human and economic vitality requires a paradigm shift. This shift leads away from treating disease and toward promoting health. Before lifestyle-induced chronic diseases emerge, before absenteeism and emergency room visits take their toll, each habit and decision shapes our health. Creating a culture of health will involve shifting these habits and decisions to support well-being.

Seizing this opportunity to shape the future is urgent. While the United States is ahead of peer nations in spending on healthcare, countries that invest in health (including physical, mental and social well-being) see better health outcomes. By refocusing attention and resources on the most harmful and costly risk factors—tobacco use, excessive use of alcohol, unhealthy diet, physical inactivity, medication non-adherence, and mental illness—we can reduce the prevalence of chronic diseases.

Fortunately, a new ecosystem of stakeholders—entrepreneurs and policymakers, researchers and health providers, large and small employers and their communities—is creating synergies of investment in population health. These stakeholders are forces for change that are likely to use new technologies to catalyze well-being.

CONNECTED SCIENCE

The art and science of health promotion and disease prevention begins with sound evidence. New tools are emerging to identify connections that were previously invisible. Universal electronic health records are providing new insights into the health of individuals and populations, e-patients are collaborating with universities, and governments are opening their data to all. Researchers, large employers, and evidence-driven journalists will all contribute data that will reveal breakthroughs to illuminate less well-understood risk factors, such as stress and mental illness.

ENTREPRENEURIAL ECOSYSTEMS

The rise of crowdfunding and innovation challenges have spurred a wave of entrepreneurship in the past decade. Innovators from technology and gaming have entered the health sector while slower-moving, established healthcare providers are being drawn into entrepreneurial experimentation. Even policymakers will develop a lean, iterative mindset over the next decade as counties and cities innovate to address local needs and risks. Urban planners, makers, and community health advocates will tinker with systems to respond to the growing burden of chronic disease.

RISE OF NETWORKS

Social networks are becoming platforms that provide motivation to make positive lifestyle changes. They also contribute to connected science and technology. Digital avatars and peer-to-peer support networks will make customized coaching affordable across diverse income groups, addressing shortages of providers and inequality of care. And the Internet of Things, smart devices that communicate with one another, will enable highly personalized incentives for healthier behavior.

FUTURE FORCES

Stakeholders across private and social sectors aligning in the coming decades

NEW BUSINESS MODELS

The escalating cost of healthcare has inspired fundamental rethinking of our approaches to treating illness and promoting health. New business models will range from private sector companies reformulating products to be healthier, to empowering patients, shifting risks, and disrupting existing payment models. Healthcare reform is mandating new payment models and sparking innovation around cost-efficient care, promoting pilot-to-scale technology opportunities, and technologies to engage patients in preventive care.

QUANTIFIED GENERATIONS

The Quantified Self movement has grown from a small group of self-tracking enthusiasts to a global phenomenon. Tools for self-measurement in the consumer marketplace will become cheaper and more accessible. The millennial generation will grow up knowing more about their bodies than anyone before. Employers and insurers will offer more tools for self-knowledge to workers, families, and communities, closing the digital health divide.

TECHNOLOGY FOR BETTER HEALTH

Evolving technologies can ease people into healthy lifestyles. The forecasts included in this map describe technology catalysts that have the potential to minimize health risk factors between now and 2030, promoting health and preventing chronic disease.

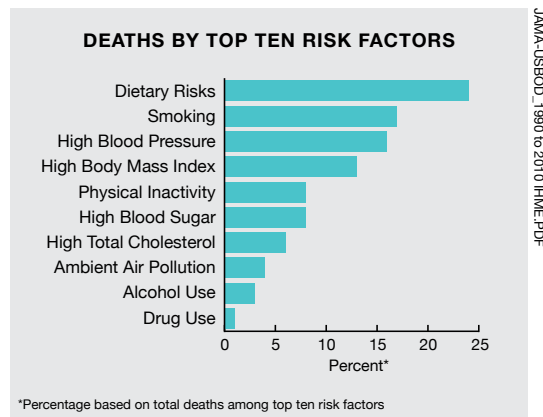
Technology
Catalysts

CRITICAL CHRONIC DISEASE RISK FACTORS

According to a report by the World Economic Forum and the Harvard School of Public Health, noncommunicable diseases (NCDs) account for 60% of deaths worldwide and 70% in the United States. One-quarter of all NCD-related deaths occur among those under the age of 60. At the top of the list globally are cardiovascular diseases, cancers, respiratory diseases, and diabetes—often caused or exacerbated by lifestyle risk factors. Timely environmental and behavioral interventions can prevent disease and save lives.

This map explores how each technology catalyst can affect the most critical lifestyle risk factors:

- Unhealthy diet
- Tobacco use
- Physical inactivity
- Excess alcohol intake
- Medication non-adherence
- Mental illness



TECHNOLOGY CATALYSTS

Ubiquitous Connectivity

Mobile platforms will integrate health data from disparate sources to provide people with a complete, integrated view of their health.

Wireless broadband and mobile networks are becoming increasingly pervasive, fast, and affordable. This will provide people and smart objects uninterrupted access to vast Internet and cloud resources. New solutions and interventions will be created to retain connection for people and devices in any context, extending beyond personal computing and smart phones. These devices are creating a powerful near-universal platform for health and well-being interventions.

Orchestrated Hardware

Sweat sensors embedded in clothing will notify the wearer when fluid intake and electrolyte replacement is optimal.

Connected devices will communicate with each other to create intelligent swarms. Many familiar devices, such as gaming consoles and medical equipment, will be integrated in new and surprising ways. Some will take the form of wearable sensors and actuators, such as smart fabrics and adhesive sensors. Others will be personal robots.

Multisensory Interfaces

People will experience the tastes and smells of their favorite foods in new ways and offset unhealthy cravings through mobile technology.

Coming decades will see the rise of interfaces that engage all senses. Technologies will act on our sense of touch, providing tactile feedback and changing form. Devices that transmit taste and smell through the Internet will proliferate. These new interfaces will combine sensory elements to create more emotional, engaging, immersive, and persuasive experiences.

Augmented Realities

Mirrors will show people their personal health status, drawing information from multiple connected devices, such as toothbrushes, scales, and smart pillboxes.

Many rooms and public places will track environmental conditions and sense, record, and learn from the pattern of human activities. Smart surfaces will have embedded interactive displays that offer real-time interaction. These systems will automatically configure environments that augment reality with virtual spaces that promote healthy choices.

High-Resolution Sensing

Eye tracking and brain games will better enable people to understand and manage their stress and sleep levels.

Tiny sensors will monitor physiological functions and environmental conditions with ever-greater fidelity. Sensors that detect gestures, analyze body movements, and track facial expressions to determine moods will be embedded in devices and physical spaces.

Data Visualization and Simulation

Wearable computers will enable people to identify composition and calories in healthy and unhealthy foods.

Rich user interfaces and photorealistic simulations will help people make sense of abundant data. Advances in rendering, simulations, and modeling will enable them to visualize objects that are otherwise too complex to grasp.

Artificial Intelligence

Artificially intelligent computer systems will indicate personalized medication doses and drug types.

The next generation of computers will use cognitive analytics, machine learning, and natural language processing to accelerate discovery and support better decision-making. The Internet will provide access to a cloud of intelligent services that will deliver intelligent computing power on demand to answer questions, offer advice, and guide people and their health providers.

Actionable Data

Big data analyses combined with behavioral economic strategies will encourage long-term engagement with physical activity technologies.

Big data will be channeled through behavioral economics to create actionable data. Scientific understanding of predictable human irrationality will help develop subtle and effective strategies that nudge people and situations to make healthy choices the easy choices.

This map is a guide to the landscape of evolving technology innovations:



FUTURE FORCES

Five future forces will reshape how new solutions in health promotion and chronic disease prevention can emerge. They frame forecasts with how stakeholders across private and social sectors will align during the coming decades.



FORECASTS AND SIGNALS

Ten forecasts anticipate how health promotion and chronic disease prevention will become central to human and economic vitality. Signals support each forecast with trends and technology advancements that show the future today.



TECHNOLOGY CATALYSTS

Technology Catalysts have the potential to change how we interact with prevention and promotion in our daily lives. These eight catalysts lay the groundwork for these interactive and immersive solutions.



Onada Health

networked support for lifestyle improvement

Peer-to-peer networks promote positive behavior solutions



Acts Connection

trauma-informed communities proliferate

Sharing of strategies improves collective mental health, resilience, and prevention

Multisensory Interfaces

PERSONAL PARTICIPATORY EVIDENCE

Online communities for sharing experiences, treatments, and genetic markers will lead to new insights and support peer-to-peer preventive care. Shared databases will reveal what underlies risk factors for effective prevention.

MICROBIAL MOBILIZATION

Microbial mapping and signatures teach us how our internal biodiversity affects risk factors, disease, appetite, and mood. Interventions into the gut-brain connection will open up new approaches linking diet and mental health.



Biome

shared microbiomes

Citizen science drives insights into how microbes affect both physical and mental well-being



my.microbes

new identities

Social networks built around types of microbiomes create new affinities

Ubiquitous Connectivity

Augmented Realities



Lumoback

wearable advisors

Personal devices nudge us to better lifestyle and diet choices



Nest

ambient intelligence

Everyday objects wired for health and sustainability keep the environment serene and support mental well-being

BRILLIANT OBJECTS

Intelligent, context-aware objects will come alive with information and interactions that support healthy behaviors, delivering nudges for healthier lifestyles.

CONNECTED SCIENCE

All stakeholders contribute data and connections to the art and science of health promotion and chronic disease prevention

AMPLIFYING AFFINITIES

Social algorithms will connect isolated people with networked ones to promote interpersonal health. Social networks will scale the lessons learned from peer-led chronic disease management into amplified population health.

PROGRAMMABLE CARE

Social bots, autonomous algorithms, and software bots will interact in more human ways—coaching, teaching, befriending, and motivating us. AI-assisted decision-making will help people care for their friends and neighbors.

RISE OF NETWORKS

Bottom-up solutions address health promotion and disease prevention

TECHNOLOGY CATALYSTS for human and economic vitality 2030

ENTREPRENEURIAL ECOSYSTEMS

Lean iteration at all levels creates vital human and economic systems

CREATING THRIVING COMMUNITIES

Abundant urban data and real-time visualization tools will create new opportunities for participatory planning, empowering citizens to have a voice in designing urban food systems, buildings, transportation, and other healthier, sustainable environments.

NEW BUSINESS MODELS

Business and social interests align for upstream interventions

WEALTH IN WELL-BEING

Health is a valuable asset. New markets will invest in health-promoting ventures that range from conventional financial models, crowdfunding, and alternative currencies to microinvesting in personal health assets and risks.



Poliwogg

health as an asset

New funding models allow investors and the public to fund health promotion and chronic disease prevention ventures

HUMAN VITALITY INDICES

The role of employers in amplifying well-being will become clearer as we link health to productivity and the bottom line. Companies that value the well-being of their workforce and community will attract the best employees and investors.



Vitality Health Index, Vitality Group

corporate health index

Performance indicators correlate competitiveness with overall workforce health status and promotion programs

CORPORATE RESPONSIBILITY INDEX

Corporate Responsibility Index

social responsibility index

Tools benchmark corporate impact on society, health, and the environment



Collective Health Impact Bonds

health impact investing

Investors finance upstream interventions and are rewarded with both a measurable social return as well as competitive financial returns

QUANTIFIED GENERATIONS

Data-driven self-knowledge ignites intergenerational health engagement and promotion

SEAMLESS WORK-LIFE INTEGRATION

Platforms and algorithms will adjust tasks to create less rigid work habits. Technologies will move people away from screens, filter light, and create bubbles of sound and silence.

PERSONALIZED PREVENTION PRESCRIPTIONS

Wearable, adhesive, and ingestible sensors will stimulate healthy habits, as inexpensive stick-on sensors and focused feedback help manage risks. Aggregating and analyzing behavior patterns will reveal new triggers for behavior change.



Zipongo

automated life managers

Intelligent systems integrate work, healthcare, and personal information to simplify tasks and reduce stress



Mobiworks

crowdsourcing platforms to restructure work

Algorithms match tasks and people to make work more effective and less stressful

High-Resolution Sensing

Actionable Data



Proteus Digital Health

cloud-enabled sensors

Ingestible monitors track and analyze medication adherence, diet, and exercise



Mioov

AI-based coaches

Next-gen fitness trackers incorporate advice and encouragement to promote activity



San Francisco Parklet to Paris

green prescriptions

Participatory planning repurposes unused city spaces in urban oases



Propeller Health

citizen sensors

Sensors combine with GPS to map environmental health—from air quality to physical activity levels

Data Visualization and Simulation

TENSIONS

Even if we act now to shape the future, getting it right is far from guaranteed. Along the way we will need to navigate tensions in how to ensure that human and economic vitality are accessible to all, especially for the technology-enabled strategies highlighted on this map.

Oversupplying the engaged vs. Inclusive innovation

Technology-enabled strategies for health promotion and chronic disease prevention will proliferate over the coming decades in the workplace, in homes, and around the built environments of communities. Early adopters will embrace new tools, technologies, and services that promise to promote health. For others, these solutions may be unaffordable, culturally inappropriate, or incompatible with people's constraints in terms of time, material, or social resources. Reaching these diverse populations will remain challenging. Tensions will not be just in providing technology, but in making it usable and accessible to all populations.

Transformed capacities vs. Real-world constraints

Technologies will transform our capacity to sense and distribute information, prevent disease, mitigate risk, and literally remake our bodies. In theory and in the lab, these new capacities may appear limitless, but in reality they will run into concrete constraints and structural barriers. Although these strategies are geared to reduce costs and disparities, technologies alone will not be able to overcome all these barriers. Where people do gain access to cutting-edge technologies, they may lack other health necessities. While innovative, low-cost, lightweight science and technology responses will partially address this tension, the constraints of finite resources, geographical access, time, and cost will persist.

Utopian optimism vs. Uneven distribution

Just as the conditions that produce good health are unevenly distributed across the United States, the optimism and will to make the most of technology-enabled strategies are unevenly distributed as well. Social barriers, fear of the unfamiliar, policy clashes, and lack of infrastructure all push back against technologies as diverse as e-cigarettes and breathalyzer locks on automobiles. Although innovations emerging from low-resource settings in poor regions may be mutually beneficial, the translation and scaling up will not always be direct or obvious.

Best intentions vs. Unintended consequences

Any new innovation brings the possibility of unintended consequences. Using personal data to improve prediction may stave off health risks but violate privacy. Intervening because a product, person, or network has a higher probability of spreading an illness may interfere with the free movement of people and goods and generate discrimination. Radical success in one area of intervention may divert resources from other important health needs. Illicit uses of new interventions will redraw lines between prevention and enhancement. As the power of data grows, so does the potential for abuse and alarm. As we look to technology to support our health, we will have to reconsider what is private and who has ownership over the enhancements that extend our potential.

COMMISSION RECOMMENDATIONS

The Vitality Institute convened the Commission on Health Promotion and the Prevention of Chronic Disease in Working-Age Americans in 2013-14 to place the power of evidence-based prevention at the center of health policies and actions in the United States. With a vision of health being embraced as a strategic imperative and a core value in society, the Commission has generated five actionable recommendations to catalyze a widespread culture of health.

1 | Invest in prevention science



Prevention science—the systematic application of scientific methods to the causes and prevention of health problems in populations—should be supported. It should also be extended beyond epidemiology and public health to include behavioral economics and new personalized technologies. Health education and leadership should reach beyond public health and policy to include medicine, law, architecture, technology, ergonomics, human factors, transportation, and agriculture.

2 | Strengthen and expand leadership to deliver a unified message for health and prevention



Advocates of prevention in the public and private sectors should be coordinated and join in common cause to develop coherent messages supporting a culture of health. A credible and influential multi-sector network should be developed that operates synergistically, using evidence-driven advocacy for the value of prevention. This includes local leaders who tackle challenges and implement solutions tailored to the needs of their communities.

3 | Make markets work for health promotion and prevention



Markets should be stimulated to encourage consumers to purchase and use healthier products and services. New products, services, and technologies for healthier lifestyles should be commercialized with the support of incentives and structures that favor innovation and early adoption.

4 | Integrate health metrics into corporate reporting



Companies should generate shared value by integrating standardized metrics on the health of their workforce into annual financial reports. Forward-thinking business leaders will understand that the health of their workforce is an asset: Human capital is core to sustained competitive advantage.

5 | Promote strong cross-sector collaborations that generate a systemic increase in health promotion and prevention across society



Non-health sectors should be engaged to tackle all factors that influence health. Advocates for health should understand the priorities of other sectors where they aspire to make progress, and they should work collaboratively to develop policies and a case for prevention.

A CALL TO ACTION

The Vitality Institute *Commission on Health Promotion and the Prevention of Chronic Disease in Working-Age Americans* intends to catalyze coordinated innovation across sectors in the United States, realizing that a healthy workforce increases productivity as well as economic vitality and personal well-being. **Use this map as a guide to explore how future innovations and new solutions might leverage technology to empower people and inform organizations to pursue a culture of health.**

STAKEHOLDERS FOR CHANGE

The Vitality Institute

The Vitality Institute applies knowledge about the evolving science and art of prevention and health promotion to building healthier societies, fostering the use of evidence-based strategies for chronic disease prevention and health promotion.

The Institute for the Future

The Institute for the Future (IFF) is an independent, nonprofit research group with more than 40 years of forecasting experience. The core of our work is identifying emerging trends and discontinuities that will transform global society and the global marketplace. We provide insights into business strategy, design process, innovation, and social dilemmas. Our research generates the foresight needed to create insights that lead to action.

Resources

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