of investment in population health. These stakeholders are forces—tobacco use, excessive use of alcohol, unhealthy habits, and each habit and decision shapes our health.

Human and economic vitality requires a paradigm shift with a new understanding of the relationships between health and economic success.

Transparent views into healthcare costs—along with data that will reveal breakthroughs to illuminate disease pathways and new approaches for prevention and care—will catalyze new business models and technologies to engage patients in overcoming these complex health challenges.

In the next decade, we have the opportunity to leverage a wave of entrepreneurship in the Internet of Things, smart wearable devices, and new personalized technologies. Health and economic vitality will be personal robots.

The art and science of health promotion and disease prevention begins with sound evidence. To respond to the growing burden of critical chronic disease risk factors, such as high Body Mass Index, Ambient Air Pollution, High Blood Pressure, and Physical inactivity, we need a national campaign to encourage people to make healthier choices and lead healthy lives.

The Commission’s five recommendations...
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. More important, the ethic of health’s role in the future is changing along with new understanding of the relationships between well-being, productivity, and habits—contributing to growing evidence that assuring human and economic vitality requires a paradigm shift. This shift leads away from treating disease with new understanding of the relationships promotion and chronic disease prevention.

In the next decade, we have the potential to maximize health risk factors between now and 2030, promoting health and preventing chronic disease.

**Electronic interfaces** will offer more tools for self-knowledge to workers, families, and communities, knowing more about their bodies than ever before. Noncommunicable diseases (NCDs) account for 60% of deaths worldwide and 70% in the United States. One-quarter of all deaths are related to obesity among those under the age of 60. At the top of this list are cardiovascular diseases, cancers, respiratory diseases, and diabetes; NCDs are caused by lifestyle risk factors. Time, environmental, and behavioral interventions can prevent disease and save lives.

The map below represents definitions of NCDs, which are the underlying causes of the top-ten risk factors. The list of key risk factors and the number of deaths and disease attributable to these risk factors are derived from the Global Burden of Disease project.

### Critical Chronic Disease Risk Factors

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Number of Deaths</th>
<th>Disease Attributable to Risk Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Total Cholesterol</td>
<td>1.5 million</td>
<td>3.5 million</td>
</tr>
<tr>
<td>High Blood Pressure</td>
<td>1.5 million</td>
<td>3.0 million</td>
</tr>
<tr>
<td>High Blood Sugar</td>
<td>1.5 million</td>
<td>2.5 million</td>
</tr>
<tr>
<td>High Body Mass Index</td>
<td>1.5 million</td>
<td>2.0 million</td>
</tr>
<tr>
<td>Tobacco Use</td>
<td>1.5 million</td>
<td>3.0 million</td>
</tr>
<tr>
<td>Physical Inactivity</td>
<td>1.5 million</td>
<td>2.0 million</td>
</tr>
<tr>
<td>Excessive Alcohol Use</td>
<td>1.5 million</td>
<td>1.0 million</td>
</tr>
<tr>
<td>Hypertension</td>
<td>1.5 million</td>
<td>1.0 million</td>
</tr>
<tr>
<td>Drug Use</td>
<td>1.5 million</td>
<td>0.5 million</td>
</tr>
<tr>
<td>Mental Illness</td>
<td>1.5 million</td>
<td>0.5 million</td>
</tr>
</tbody>
</table>

**New business models** will expand the reach of healthcare by transforming the way we produce and consume services. New business models will rely on pay-per-service sector companies refocusing products to serve pay-per-service patients. Specialized models will be developed for chronic disease, risk factors, and combination of malignancy and smoking innovation around mobile technologies for patient support and health-related technology opportunities, and will support health education in preventive care.

**Orchestrated Hardware** will develop clothing that will notify the wearer of dangerous surroundings, personal electronics replacement in optimal. Connected devices will communicate with one another to keep people healthy, safe, and affordable. This will provide people and businesses a chance to take control of their health system and stop using medical specialists. New solutions and interventions will be able to be used by those who are affected by depression, high blood pressure, and smoking.

**Augmented realities** will show people their personal health status, drawing information from multiple connected devices, such as health centers, scales, and smart pillows. Many, many and public places will track environmental conditions and history, record, and learn from the pattern of human activity. Smart surfaces will have interactive displays that offer real-time information. These systems will provide us with more information that augment reality with virtual spaces that promote healthy choices.

**High-resolution sensing** eye tracking and brain waves will better enable people to understand and manage their stress and sleep levels. Tiny sensors will monitor physiological function and environment contexts to detect signals, analyze body movements, and inform decisions. These sensors will be embedded in devices and physical spaces.
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.

More than ever, the health of the country is beginning to be shaped by the activities of a new ecosystem of stakeholders—entrepreneurs, urban planners, technologists, and medical experts. By working together, we can transform the art and science of health promotion and chronic disease prevention, closing the digital health divide.

As the costs of chronic diseases rise, we have an unprecedented opportunity to make everyone a partner in health. 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 those in low-resource settings.

The opportunity is both near-universal and powerful. The era of innovation is closing in, allowing us to harness the power of technology to improve health and well-being. Technologies will transform our capacity to sense and distribute information, prevent disease, and mitigate risk, and literally remake our bodies.
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 articulate 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 innovative solutions.

---

**Programmable Care**

Social bots, autonomous algorithms, and software bots will interact in new human veins—coaching, teaching, helping, and motivating us. Automated decision-making will help people care for their friends and neighbors.

**Quantified Generations**

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

**Personal Participatory Evidence**

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

**Microbial Mobilization**

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

**Personal Health Exploration Platforms**

Analytical tools allow individuals to better lifestyle and nutrition data—better interact with genetic risk factors.

**Peer-to-Peer Health Sharing**

Platforms and researchers work together to co-create breakthroughs.

**Brilliant Objects**

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

**Creation 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.

**Entrepeneurial Ecosystems**

Lean iteration at all levels creates vital human and economic systems.

**Technology Catalysts for Human and Economic Vitality 2030**

- Artificial Intelligence (AI)
- Quantified Generations
- Personal Participatory Evidence
- Microbial Mobilization
- Personal Health Exploration Platforms
- Peer-to-Peer Health Sharing
- Brilliant Objects
- Creation Thriving Communities
- Entrepeneurial Ecosystems

---

**Connected Science**

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

**New Business Models**

Business and social interests align for upstream interventions.

---

**(actionable data)**

- High-resolution sensing
- Cloud-enabled sensors
- Wearable advisors
- Augmented realities

**(ubiquitous connectivity)**

- Multisensory interfaces
- Ubiquitous

**(programmable care)**

- Emotionally sensitive robots
- Virtual reality-based behavior training
- Orchestrated hardware

**(quantified generations)**

- Actionable data
- Seamsless work-life integration
- Cloud-enabled sensors
- Wearable advisors

**(personal participatory evidence)**

- Online communities for sharing experiences, treatments, and genetic markers
- Personal health exploration platforms
- Peer-to-peer health sharing

---

**(technology catalysts)**

- Actionable data
- Ubiquitous connectivity
- Programmable care
- Quantified generations
- Personal participatory evidence
- Microbial mobilization
- Personal health exploration platforms
- Peer-to-peer health sharing
- Brilliant objects
- Creation thriving communities
- Entrepreneurial ecosystems

---

**(connected science)**

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

---

**(new business models)**

- Business and social interests align for upstream interventions.

---

**(technology catalysts for human and economic vitality 2030)**

- Artificial intelligence
- Quantified generations
- Personal participatory evidence
- Microbial mobilization
- Personal health exploration platforms
- Peer-to-peer health sharing
- Brilliant objects
- Creation thriving communities
- Entrepreneurial ecosystems

---

**(connected science)**

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

---

**(new business models)**

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

Technology-enabled strategies for health promotion and chronic disease prevention will be leveraged over the coming decade as businesses, communities, and individuals in diverse environments of communities. Early adopters will embrace new tools, technologies, and services that promise to improve health. For others, these solutions will be culturally inappropriate, or incompatible with people’s circumstances in terms of time, material, or social resources. Reaching these diverse populations will remain a challenge. Technology-enabled strategies will not be just in providing technology, but in making it usable and accessible to all populations.

**TENSIONS**

- **Oversupplying the engaged vs. Inclusive innovation**
  Technology-enabled strategies for health promotion and chronic disease prevention will not always be perfect. It will also be expanded beyond epidemiology and public health methods. Traditional public health, however, is not a solution to these challenges. Technology-enabled strategies will need to be able to meet the needs of communities. When people gain access to cutting-edge technologies, they are more likely to be effective. Science and technology responses will partially address this tension. The constraints of free resources, geographical access, time, and costs 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 unknown, policy changes, and lack of infrastructure all play against technologies as diverse as cigarettes and hypertension, let alone ambulances. Although innovations emerging from low-resource settings in poor regions may be more immediately usable, the translation and scaling will not always be clear or obvious.

- **Best intentions vs. Unintended consequences**
  No new technology brings the possibility of unintended consequences. Using personal data to personalize health recommendations, for example, can lead to unintended consequences such as privacy violations. People may be more likely to share personal data, and technologies for healthier choices can be leveraged. However, technology enablement strategies can have]
for change that are likely to use new technologies to catalyze.

Fortunately, a new ecosystem of stakeholders—entrepreneurs and urban planners—will help make customized coaching interventions possible. They will identify and engage people who might be at risk for unhealthy habits, and then provide highly personalized incentives to promote and chronic disease prevention.

Seizing this opportunity to shape the future is urgent. While the shift is happening, each habit and decision shapes our health.

In the next decade, we have the opportunity to incentivize and spark innovation around healthier behavior. Stakeholders across sectors will offer more tools for self-knowledge and evidence-driven journalists will all contribute.

The escalating cost of healthcare and the massive toll, each habit and decision shapes our health.

Promotion and chronic disease prevention across society. 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.

Overupplying the engaged vs. Inclusive innovation

Technology-enabled strategies for health promotion and chronic disease prevention will transform our capacity to sense and distribute information, prevent disease, and guide people and their health providers.

Transformed capacities vs. Real-world constraints

To avoid sharing information with others, people are more likely to make healthy choices in private situations and make unhealthy choices in public situations. This human irrationality will help develop subtle behavioral economic strategies will be just in providing technology, but in making it usable and accessible to all populations.

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 changes, and lack of infrastructure in rural areas where technology adoption mat be at a standstill.

Although innovations emerging from low-resource settings in poor regions may be able to overcome some of these barriers, people who gain access to cutting-edge technology will not have the time, training, or equipment to make full use of this technology.

Best intentions vs. Unintended consequences

New innovation brings the possibility of unintended consequences. Using personal data to make predictions about people’s health and behavior could be incredibly powerful, but it also could be at risk if used in a way that violates people’s privacy.

The implications of technology-enabled strategies should be evaluated in the context of shifting health habits and decisions to support well-being.

TENSIONS

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 and ultimately, our 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.

Technology for Better Health

The Vitality Institute applies knowledge about the evolving science and art of prevention and health promotion to building healthier societies, fostering empowerment people and informing organizations to pursue a culture of health.

Technology CATALYSTS for human and economic vitality 2030

1. Invest in prevention science

Prevention science—the systematic application of scientific methods to develop health-promoting actions that work. The Commission’s recommendations are supported. It will also be extended beyond epidemiology and public health science to include social, economic, and behavioral science.

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 held to a high standard and be able to speak with one voice and generate messages that clearly explain the value of prevention.

3. Make markets work for health promotion and prevention

Markets should be stimulated to encourage consumer choice and purchase of products and services that support health lifestyles.

4. Integrate health metrics into corporate reporting

Companies should generate shared value by integrating standardized metrics and motivating stakeholders to act. The financial benefits of health improvements will incentivize leaders to understand that the health of their workforce is an asset, not a liability. Every company can make a difference.

5. Promote cross-sector collaborations that encourage a culture of health and prevention

New sectors must be engaged to tackle all factors that influence health. Technologies for health should be reimagined and disseminated by these sectors where they aspire to make progress, and they should work collaboratively to develop policies and a case for prevention.