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# The secret to great health? Escaping the healthcare matrix

The blueprint to achieve a lifetime of great health is increasingly clear and within our control. But unlocking it requires challenging the orthodoxies currently guiding individuals and institutions.

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**Each day, millions** of well-intended healthcare professionals, scientists, and public health officials work diligently to improve our health.[1] Their work has had a profoundly positive impact on global health over the past 50 years and deserves our admiration.

At the same time, scrutinizing our mindsets and behaviors against the best-available evidence reveals that the priorities, strategies, and budgets for individuals and of governments, schools, businesses, social institutions, healthcare providers, and employers are, at least implicitly, based on a myriad of half-truths and outdated ideas.

To borrow the metaphor from the 1999 eponymous movie classic,[2] we have all been living in a "matrix" for decades with respect to our health. Life inside the healthcare matrix has its benefits but is incomplete and self-limiting. Once we escape from this matrix, we will realize the following:

1. The suffering we endure to achieve longevity is unacceptable and unnecessary.
2. Mental, social, and spiritual health are as important as physical health and are deeply interconnected.
3. Health is mostly about our ability to function, not just about disease and death.
4. Health exists on a spectrum: we can't achieve optimal health if we don't define, measure, or strive for it.
5. *Most* drivers of health sit *outside* conventional healthcare systems and are *modifiable*.
6. Achieving great health is as much about what we pursue as what we avoid.
7. People are more than patients; they deserve to be empowered with greater health literacy.
8. History suggests that the societal adaptations required to improve health are feasible; every person and institution on Earth has a role to play.

The arguments in this article are globally relevant, although we acknowledge that, in some contexts, the lack of physical or economic security may severely limit the positives and potential of other drivers of health.

## 1. The suffering we endure to achieve longevity is unacceptable and unnecessary

*Do you accept that you'll probably spend 20 to 30 years in mixed (at best) health and about a decade in awful health—where you can't remember your children, use the bathroom independently, have sex, walk around the block, or use all five senses?*

Children born today can hope to live 20 years longer than their grandparents born in the 1960s.[3] The number of centenarians has increased nearly 30 times in the same time frame and is becoming a global phenomenon in many middle- and high-income countries.[4] As such, these are terrific developments.

But the cost of increased life expectancy has been high. For every extra year of life we have added to our life span, half of that may be in moderate or poor health. This ratio has been roughly constant for decades (Exhibit 1).

Up to two-thirds of people experience cognitive impairment around the age of 70.[5] Sixty-nine percent of people will spend an average of three years using long-term care[6]; 770 million people

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1 Through their own work in the health sector over many years, the authors consider themselves affiliated to this community.

2 *The Matrix* is a US–Australian science fiction movie from 1999 that deals with alternative worlds individuals need to choose between. The world inside the matrix is not unpleasant: it's relatively safe, internally consistent, but obstructs the insights into and path toward a potentially better authentic life. The world outside the matrix holds the promise of a more authentic, better life, but it is fundamentally risky, as it requires exploring uncharted territory. The authors are fans of the movie and dissociate themselves from its appropriation by political extremists and conspiracy theorists.

3 "Life expectancy at birth, total (years) database," World Bank Data, accessed December 13, 2021; "Global burden of disease study 2019, demographics 1950–2019," Institute for Health Metrics and Evaluation, accessed December 13, 2021.

4 Katharina Buchholz, "Is 100 the new 80?: Centenarians are becoming more common," Statista, February 5, 2021.

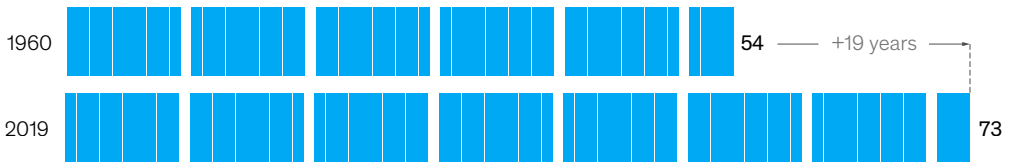
5 Jo Mhairi Hale et al., "Cognitive impairment in the U.S.: Lifetime risk, age at onset, and years impaired," *SSM Population Health*, 2020, Volume 11.

6 "How much care will you need?," LongTermCare.gov, February 18, 2020.

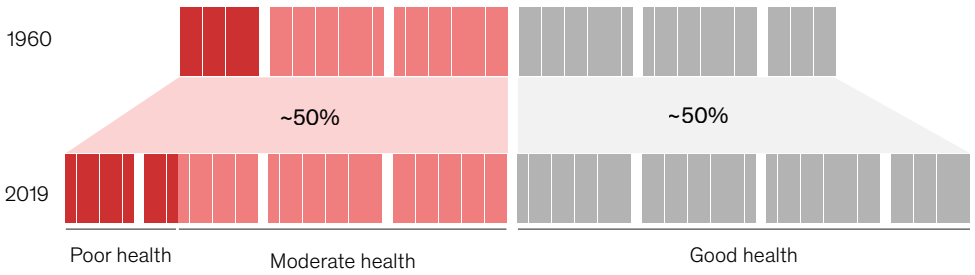
Exhibit 1

## People are living longer, yet spend more years in moderate or poor health.

**Average global life expectancy,** years




**Global health years as % of life expectancy**




Source: Institute for Health Metrics and Evaluation; World Bank; McKinsey analysis

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experience chronic pain,[7] 300 million people are incontinent,[8] 19 million US residents not in a hospital find it difficult to walk a mile,[9] 33 percent of men and 45 percent of women experience sexual dysfunction,[10] 548 million experience symptoms of anxiety or depression,[11] and 33 percent of people worldwide feel lonely.[12]

Inside the healthcare matrix, we have two primary responses to this reality. Some conclude that too many people live too long and have suggested reducing resources invested in older adults.[13] Most implicitly accept that living decades in poor health is lamentable but is an inevitable consequence of having a long life.

Outside the matrix, we strongly reject both responses. We conclude that the best response is harnessing individual and collective aspirations to fight for strong health until as close to death as possible. As outlined in the McKinsey Health Institute (MHI) report *Adding years to life and life to years*, there is a large body of evidence demonstrating that strong health over an extended

7 Laura Smith, "Chronic pain statistics," The Good Body, November 18, 2022.
8 Samantha Hall, "What percentage of the population are affected by incontinence?," Incontinence UK, February 7, 2019.
9 Lisa I. Iezzoni, "Mobility difficulties are not only a problem of old age," *Journal of General Internal Medicine*, 2001, Volume 16, Number 4.
10 Peer Briken, "Estimating the prevalence of sexual dysfunction using the new ICD-11 guidelines," *Deutsches Ärzteblatt International*, 2020, Volume 117, Number 39.
11 Saloni Dattani, Hannah Ritchie, and Max Roser, "Mental health," Our World in Data, August 2021.
12 "Feeling of loneliness among adults 2021, by country," Statista, November 29, 2022.
13 Stephen S. Hall, "A doctor and medical ethicist argues life after 75 is not worth living," *MIT Technology Review*, August 21, 2019.

period of life is possible. We observe it in select individuals, populations, and societies. It is possible to "square the curve" of health. Our analysis suggests it's possible to add six years of higher-quality life to every person on the planet over the next decade. That's 45 billion years in total.

## 2. Mental, social, and spiritual health are as important as physical health and are deeply interconnected

*How important is your mental, social, and spiritual health to you? Do you observe linkages between your own mental, physical, social, and spiritual health?*

Inside the matrix, people and systems focus almost entirely on physical health. In 2020, less than 2 percent of physicians and nurses worldwide were trained in managing mental health problems.[14] More than 90 percent of all healthcare expenditures are spent on treating physical disease or physical symptoms.[15] Most countries don't even attempt to systematically measure mental health, let alone social or spiritual health.

Outside the matrix, we realize that mental, social, and spiritual health are important in and of themselves. In a survey of 19,000 people across 19 countries,[16] around 85 percent of respondents said their mental health is as important to them as their physical health, and their spiritual and social health were also listed by the majority as "extremely" or "very important." People share this view across high-, middle-, and low-income countries.

Outside the matrix, we recognize that a large and growing body of research is catching up to a few thousand years of philosophical and religious teachings that recognize the linkages among body, mind, and spirit. University of Michigan researchers concluded that people without a strong life purpose were more than twice as likely to die, specifically from cardiovascular disease, than those who did have a strong life purpose.[17] Scientists at the Chonnam National University Medical School in South Korea found a link between anxiety and eyesight problems.[18] Finally, research from National Academies of Sciences found that loneliness among heart failure patients was associated with around a four times increased risk of death and a 68 percent increased risk of hospitalization.[19]

## 3. Health is mostly about our ability to function, not just about disease and death

*When someone asks, "How's your health?" how do you answer?*

Inside the matrix, health is anchored in the absence or presence of disease, illnesses, and injury. Clinicians, insurers, academics, and governments use "mortality" and "morbidity," jargon words for death and disease to guide decision making and resource allocation. We discuss, measure, and pay for healthcare based on whether you "have heart failure" or don't. We approve, promote, and pay for drugs, devices, and clinical interventions based on their potential impact on disease and death. These are important and useful concepts, but they are also limiting.

We typically[20] don't define or measure functional implications on our life until and unless it is related to a disease or injury. For example, an orthopedic surgeon may measure knee, hip, or shoulder flexion (the ability to bend) after a surgery to gauge the progress of recovery. But knee flexion is not measured or discussed unless a knee problem emerges even though it is necessary for our ability

[14] Tarik Endale, "Barriers and drivers to capacity-building in global mental health projects," *International Journal of Mental Health Systems*, 2020, Volume 14, Number 89.
[15] "WHO says governments spend only 2% of budget on mental health," Open Access Government, March 3, 2022.
[16] Clément Desmouceaux, Martin Dewhurst, Daphné Maurel, and Lorenzo Pautasso, "In sickness and in health: How health is perceived around the world," McKinsey, July 21, 2022.
[17] Aliya Alimujiang et al., "Association between life purpose and mortality among US adults older than 50 years," *JAMA Network Open*, 2019, Volume 2, Number 5.
[18] Hee-Ju Kang et al., "Impact of anxiety and depression on physical health condition and disability in an elderly Korean population," *Psychiatry Investigation*, 2017, Volume 14, Number 3.
[19] "Loneliness and social isolation linked to serious health conditions," Centers for Disease Control and Prevention, Accessed December 5, 2022.
[20] Eyesight and hearing are two exceptions where there are strong standards to understand function. Eyesight and hearing are two examples of functions that are reasonably well defined and consistently measured.

to walk, lift, and exercise correctly[21] and to avoid slips and falls.

Inside the matrix, there are no broadly used standards for measuring the holistic physical function (for example, walking, gripping, and balancing) of a disease-free 40-year-old woman or the cognitive function (for example, memory, problem-solving) of a disease-free 50-year-old man. This lack of measurement reveals the lack of focus or concern with function.

Outside the matrix, we realize that the absence of disease does not, necessarily, imply great health. Similarly, the presence of disease does not, necessarily, impede function, especially if symptoms are well managed. This reality was substantiated by MHI's 2022 survey in 19 countries—40 percent of those reporting a disease perceived their health as "good" or "very good."

These respondents recognize that health is mostly about living. Strong health helps us lead meaningful, productive, and satisfying lives. Health is the extent to which we have physical and mental energy, whether we can fully use our senses, and the extent to which we can comfortably engage in meaningful activities. Health is our strength, our memory, our ability to solve problems; it is our ability to cope with the challenges of life, our ability to build and sustain intimacy, and our sense of agency, positivity, and purpose (Exhibit 2).

*Health is fundamentally about what an individual can do (or not) today and what they are able to do (or not) in the future.*

Once we escape from the matrix, we realize that we need better, more standard ways to define, measure, and talk about function across all dimensions of health.

## 4. Health exists on a spectrum: We can't achieve optimal health if we don't define, measure, or strive for it

*If you ask your daughter how she's doing in geometry, would you be satisfied if she responded*

Exhibit 2

### Health is mostly about function, not disease or death.

**Key aspects of function, by dimension of health**

**Physical**
- physical energy/vitality
- absence of pain
- senses (sight, hearing, smell, taste, touch)
- movement
- sexual function
- continence

**Mental**
- mental energy/stamina
- cognition (memory, problem solving)
- resilience
- coping
- positivity
- agency

**Social**
- ability to create and maintain healthy relationships
- ability to participate actively in a community
- empathy
- self-awareness

**Spiritual**
- meaning and purpose
- centeredness
- healthy sense of self/ identity
- hopefulness
- gratitude
- appreciation of beauty

Note: Grounded in the World Health Organization's (WHO's) definition of health: "A state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity"; *Constitution of the World Health Organization*, WHO, 1948.

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[21] Nirtal Shah, "Increasing knee range of motion using a unique sustained method," *North American Journal of Sports Physical Therapy*, 2008, Volume 3, Number 2.

*"Great. I didn't fail the last test"? How well would a football club perform if it only practiced defense? If you asked your physician, "Am I in optimal health?" how would they answer?*

Inside the matrix, health is framed almost exclusively in the negative. Achieving a "clean bill of health" means that you haven't been diagnosed with a disease or a major risk factor of disease. Patients are categorized based on the level of the problem: a standard "acuity table" consists of four levels: stable, moderate risk, complex patient, and high-risk patient. The best is "stable" health.

Globally, we spend more than $8 trillion annually to avoid disease, symptoms, and death, yet there are no commonly accepted words or standards to delineate mediocre from great health.[22]

Inside the matrix, the concept of achieving "optimal" health is relegated to the domain of "biohackers," affluent middle-aged people in high-income countries, professional athletes, and celebrities. The implicit assumption is that aspiring to optimal health is a luxury that few can afford metaphorically and literally.

Outside the matrix, we realize that health exists on a spectrum with a negative and positive or optimal end. We realize that achieving better-than-mediocre health is feasible in large numbers. Our recent research supports this conclusion. Of the 13,200 people across 19 countries who reported no disease, around 25 percent indicated being in "very good" health, 55 percent in "good" health, and 20 percent in "fair" or "poor" health. This spectrum of responses was similar across high-, middle-, and low-income countries and across age bands. (Exhibit 3).

Outside the matrix, we aspire to be more than not sick, not disabled, and not suicidal. We want vitality, centeredness, and resilience. We want our brains to work the best they can. We want to be good at building intimacy. We want to be able to walk, play, carry, and build for as long as possible without discomfort.

Outside the matrix, we recognize that striving to achieve optimal (over mediocre) health is a highly effective prevention strategy. We also recognize that aspiring for optimal health is an effective approach to generate real-time, concurrent benefits to individuals and society. A disease-free person who successfully improves their metabolic health, learns to navigate their emotions, prioritizes sufficient high-quality sleep, and avoids harmful content, substances, and stress is likely to enjoy more energy, build stronger relationships, and enhance personal productivity. They are more likely to be a better colleague at work, a better spouse, a better parent, and a better friend (Exhibit 4).

## 5. *Most* drivers of health sit *outside* conventional healthcare systems and are *modifiable*

*If changing an aspect of your life within your control decreased the odds of acquiring dementia by 25 percent, would you want to know about it? Would you expect your physician to tell you about it? Would you expect your government, private insurer, or employer to help you achieve it?*

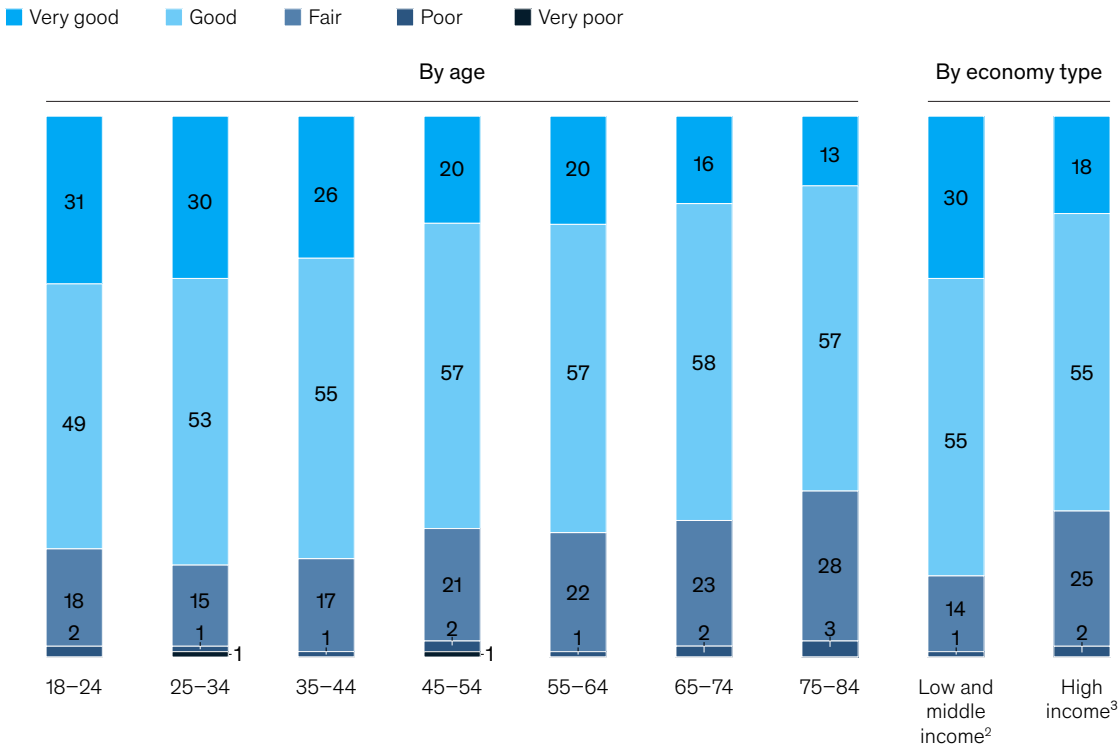
Inside the matrix, we assume that the primary drivers of an individual's health are genetics, chance, and access to and adoption of conventional healthcare interventions. We define conventional healthcare interventions as a handful of widely adopted public health strategies (for example, vaccines, sanitation, seat belts, and smoking cessation), the timely detection and diagnosis of disease, and access to clinical interventions like pharmaceuticals, surgery, and therapy provided by licensed clinicians. More than 97 percent of health-related public-, private-, and social-sector expenditures in OECD countries are related to delivering conventional healthcare interventions.[23]

[22] "Global spending on health: Weathering the storm," WHO, December 2020.
[23] "Health spending in most OECD countries rises, with the U.S. far outstripping all others," Organisation for Economic Co-operation and Development, March 6, 2004.

Exhibit 3

## Health exists on a spectrum across ages and economies, independent of disease status.

**Perceived overall health when no disease was reported,**[1] % of respondents (n = 13,200)




[1]Figures may not sum to 100%, because of rounding.
[2]Argentina, Brazil, China, Egypt, India, Indonesia, Mexico, Nigeria, South Africa, and Turkey.
[3]Australia, France, Germany, Italy, Japan, Sweden, Switzerland, UK, and US.
Source: Institute for Health Metrics and Evaluation; World Bank; McKinsey analysis

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When we acknowledge the relevance of a handful of nonconventional drivers such as diet, exercise, and substance use, we frequently refer to these drivers with dismissive terms such as "lifestyle." Deconstructing that word is revealing: the word "life" reflects the belief that the extent to which these drivers are optimized (or not) is mostly the purview of the individual and not affected by systems and structures of society (for example, employment, education, food availability, economics, and social context). The word "style" implies superficiality or inferiority compared to what we consider more legitimate interventions that we label with credibility-enhancing qualifiers like "clinical."

Inside the matrix, we assume that the evidence for conventional health system interventions is much stronger and more reliable than the evidence for interventions associated with

Exhibit 4

## The first step to achieving optimal health is to define it.

### Examples of health status, by dimension

WORST → BEST

| | Exacerbation | Poor health | Fair health | Strong health |
|---|---|---|---|---|
| **Physical** | • physical-health hospitalization<br>• serious accident | • high uncontrollable pain<br>• serious functional limitations<br>• significant fatigue | • regular bouts of fatigue<br>• some functional limitation<br>• unintended physical discomfort | • high stamina/energy<br>• excellent physical mobility, strength, balance, acuity<br>• full sensory function |
| **Mental** | • mental-health hospitalization<br>• suicide attempt<br>• burnout or "breakdown" | • symptoms of untreated mental illness<br>• partial cognitive capacity<br>• severe lack of motivation | • bouts of anxiety/ depression<br>• regular lack of motivation<br>• stress affects sleep | • high resiliency<br>• setbacks lead to growth<br>• full cognitive capacity—think, learn, remember, create |
| **Social** | • toxic behavior/outburst<br>• overdose abuse<br>• suicide attempt | • social isolation<br>• poor ability to build and maintain healthy relationships | • mixed social interaction<br>• modest empathy<br>• modest community affiliation | • infectious positivity<br>• robust support network<br>• high empathy<br>• deep community affiliation |
| **Spiritual** | • toxic shame<br>• hopelessness | • no sense of purpose or belonging, and unhealthy sense of identity | • mixed sense of purpose, belonging, and identity | • deep sense of purpose, belonging, and identity |

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nonconventional drivers. Outside the matrix, we recognize that conventional healthcare drivers are critical. Creating more and more equitable access to these resources is just and economically wise. Greater investment to improve conventional interventions offers substantial potential benefits.

We *also* recognize that a large and growing body of evidence suggests that at least 19 of the 23 drivers of our health sit outside conventional healthcare systems. Each of these drivers appears to have an independent, direct, material, and causal impact on our health. These drivers include what we put into our bodies, how we spend our time, when and how we move, what our minds and bodies are exposed to, and what we believe about the nature of reality, ourselves, and other people.

*Note: Drivers of health are complex and nonlinear (eg, J-curves, U-curves), interact with one another and their effects can vary by genetics, traits, randomness, etc. Each driver can be optimized (or un-optimized) based on quantity, type, mix, duration, timing/ sequencing and can be a result of both individual choices and structural/environmental influences.*

*(We also provide more detail on evidence of these drivers in "The healthy 23: Drivers of your health and longevity" at the end of the article.)*

**Table. The healthy 23: Drivers of health**

Each driver can be optimized or not based on both individual choices and structural/environmental influences. These drivers are in no specific order.

| | | |
|---|---|---|
| Physical inputs | Diet | Food selection; portions; preparation; eating timing; macro/micro nutrients; fasting/calorie restriction; water consumption |
| | Supplementation | Frequency; extent of use; type (eg, extracts, teas, vitamins, mineral, herb, botanicals, amino acids, metabolite, probiotics, caffeine) |
| | Substance use | Frequency; extent of use; type (eg, alcohol, tobacco/nicotine, vaping, cocaine, marijuana, heroin, psilocybin) |
| Movement | Mobility | Mix of time by position; Standing, sitting, walking, posture, typing, neck position, use of fine motor skills |
| | Exercise | Duration; frequency; type (eg, sports, endurance, high intensity, strength/resistance, stability, flexibility, coordination, individual/group) |
| | Sleep | Quality; duration; mix by stages; regularity; consistency; alignment to circadian rhythm |
| Daily living | Productive activity | Work, volunteering, caregiving, hobbies, worshipping, activism, playing music, arts/crafts, travel |
| | Social interaction | Conversations, meals, vocational interaction, friendships, physical intimacy, marriage/dating, activities; in-person or remote |
| | Content consumption | Entertainment, literature, news, music, pornography; all formats—online, apps, social medial, paper, in-person, TV, gaming |
| | Hygiene | Handwashing, bathing, showering, oral care, ear protection, grooming |
| Exposure | Nature | Time among forests, flowers, bodies of water, wildlife/insects, mountains; day/night sky |
| | Atmosphere | Temperature; humidity; weather, weather events; radiation; smoke; high heat/cold exposure (sauna, cold plunge) |
| | Sensory | Screens; sun/exterior light; type/degree of interior light; noise—type, intensity, duration |
| | Materials | Type (air, water, surfaces, fabrics, containers); contents (toxins, germs, pollutants, heavy metals, allergens) |
| | Stress | Response to physical, emotional and/or mental challenge (pressure, trauma, excitement); acute and chronic; includes eustress |
| State of being | Mindsets/beliefs | Attitudes/perspectives toward all aspects of life: religion/philosophy, optimism, agency, nature of people, purpose, hope |
| | Body composition | Body fat by type of fat; lean muscle mass; morbid obesity |
| | Physical security | Physical security/safety: absence of war, armed conflict, criminal violence, domestic violence, avoidable accidents |
| | Economic security | Food security, housing security, income security, access to health care |
| Healthcare | Vaccination | Regularity and extent of vaccination: MMR, flu, COVID, TB, polio, tetanus |
| | Detection/ diagnosis | Monitoring; testing; screenings; genetic testing; diagnosis of risk factors, disease and/or conditions |
| | Clinical intervention | All forms of clinical treatment: surgeries, device implant, pharmacologic; therapy; hearing aids; other medical devices |
| | Adherence | Extent to which an individual follows a prescribed treatment plan including interventions, extent, frequency, duration, method |

Thousands of studies and even more anecdotal evidence highlight that these drivers are often the difference between decades of strong function and decades of poor health and/or premature death. Examples include the following:

— Multiple studies demonstrate that exercise alone can deliver between three and five years of extended life and between five and ten years of improved quality of life.[24] Cardio training, strength/resistance training, and high-intensity exercise all appear to be independently valuable and important.[25]

— Optimistic/positive people (a learned behavior) are 35 percent less likely to experience a cardiovascular event compared to a pessimist holding other variables constant. Positivity has also been shown to reduce the prevalence and symptoms of depression and anxiety and improve immune-system function.

— Regular use of saunas at high temperatures decreases the risk of all-cause mortality by as much as 40 percent and the risk of dementia by as much as 66 percent.[26]

— Fasting has shown the ability to reverse type 2 diabetes in large portions of people and reduce the likelihood of cognitive decline. Emerging research is demonstrating that ketogenic diets can help treat serious mental illness.[27] Higher blood glucose levels in nondiabetics is associated with between a 30 percent and 40 percent higher likelihood of cardiovascular and cancer-related death.[28]

— Multiple studies have found DHA (docosahexaenoic acid) and EPA (eicosapentaenoic acid) supplementation (fish oil) can lower the risk of cognitive decline, especially in people at high risk for Alzheimer's disease.[29]

— Dozens of studies demonstrate that walking reduces chronic pain, strengthens the immune system, and decreases anxiety, sadness, and fatigue.[30]

— A recent randomly controlled experiment demonstrated that exposure to nature for 60 minutes reduced stress and improved the brain's ability to successfully navigate future stressors.[31]

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[24] Kyle Mandsager et al., "Association of cardiorespiratory fitness with long-term mortality among adults undergoing exercise treadmill testing," *JAMA Network Open*, 2018, Volume 1, Number 6; Dong Hoon Lee et al., "Long-term leisure-time physical activity intensity and all-cause and cause-specific mortality: A prospective cohort of US adults," *Circulation*, 2022, Volume 146, Number 7; Carl D. Reimers et al., "Does physical activity increase life expectancy? A review of the literature," *Journal of Aging Research*, 2012, Volume 2012, Number 11; Karmel W. Choi et al., "Assessment of bidirectional relationships between physical activity and depression among adults: A 2-sample Mendelian randomization study," *JAMA Psychiatry*, 2019, Volume 76, Number 4.

[25] Jessica Gorzelitz et al., "Independent and joint associations of weightlifting and aerobic activity with all-cause, cardiovascular disease and cancer mortality in the prostate Lung, Colorectal and Ovarian Cancer Screening Trial," *British Journal of Sports Medicine*, 2022, Volume 56, Issue 22; Haruki Momma et al., "Muscle-strengthening activities are associated with lower risk and mortality in major non-communicable diseases: A systematic review and meta-analysis of cohort studies," *British Journal of Sports Medicine*, 2022, Volume 56, Issue 13.

[26] Tanjaniina Laukkanen et al., "Association between sauna bathing and fatal cardiovascular and all-cause mortality events," *JAMA Internal Medicine*, 2015, Volume 175, Number 4; "Regular saunas could reduce the risk of dementia, new study finds," Alzheimer's Society, December 16, 2016.

[27] Christopher M. Palmer, *Brain Energy: A Revolutionary Breakthrough in Understanding Mental Health – and Improving Treatment for Anxiety, Depression, OCD, PTSD, and More*, Dallas, TX; BenBella Books, November 15, 2022.

[28] Yilin Yoshida et al., "The effect of metabolic risk factors on cancer mortality among blacks and whites," *Translational Cancer Research*, 2019, Volume 8, Number 4; Emily B. Levitan et al., "Is nondiabetic hyperglycemia a risk factor for cardiovascular disease? A meta-analysis of prospective studies," *JAMA Internal Medicine*, 2004, Volume 164, Number 19; Hilde Kristin Refvik Riise et al., "Casual blood glucose and subsequent cardiovascular disease and all-cause mortality among 159 731 participants in Cohort of Norway (CONOR)," *BMJ Open Diabetes Research and Care*, 2021, Volume 9, Issue 1.

[29] Yu Zhang et al., "Intakes of fish and polyunsaturated fatty acids and mild-to-severe cognitive impairment risks: A dose-response meta-analysis of 21 cohort studies," *The American Journal of Clinical Nutrition*, 2016, Volume 103, Issue 2; Greg M. Cole et al., "Omega-3 fatty acids and dementia," *Prostaglandins Leukot Essent Fatty Acids*, 2009, Volume 81, Issue 2–3.

[30] Ekalak Sitthipornvorakul et al., "The effects of walking intervention in patients with chronic low back pain: A meta-analysis of randomized controlled trials," 2017, Volume 34; Dana Guglielmo et al., "Walking and other common physical activities among adults with arthritis — United States, 2019," *Morbidity and Mortality Weekly Report*, 2021, Volume 70, Number 40; David C. Nieman et al., "Upper respiratory tract infection is reduced in physically fit and active adults," *British Journal of Sports Medicine*, 2011, Volume 45, Issue 12; Felipe B. Schuch et al., "Physical activity protects from incident anxiety: A meta-analysis of prospective cohort studies," *Depression & Anxiety*, 2019, Volume 9; Chorong Song et al., "Psychological benefits of walking through forest areas," *International Journal of Environmental Research and Public Health*, 2018. Volume 15, Number 12.

[31] Sonja Sudimac et al., "How nature nurtures: Amygdala activity decreases as the result of a one-hour walk in nature," *Molecular Psychiatry*, 2022.

— More than five hours of daily social media use was associated with between a 35 and 50 percent increased risk of depressive symptoms in adolescents.[32]

— A recent review of medical literature suggests that human sperm counts have fallen by more than 50 percent around the globe over the past 50 years. While the causes are unknown, the lead research suggests that exposure to man-made chemicals, obesity, sedentariness, and ultraprocessed food may play a role.[33]

What's more, these drivers are *modifiable*. They can be improved or weakened based on both individual choices and how systems and structures operate. This is incredibly positive news.

Perhaps for the first time in history, most of us have meaningful agency over our health for most of our lives, regardless of our genetics.

Outside the matrix, we realize that most of the distinctions between "clinical" and "lifestyle" interventions are *mostly* artificial. Why is a pill or surgery a more legitimate health intervention than calorie restriction, lifting weights, meditating, avoiding particular content, or walking in nature? If it works, it works. If it doesn't, it doesn't.

Outside the matrix, we recognize that the totality of evidence is already overwhelming that nonconventional, modifiable drivers of health are deeply relevant to our health. A substantial body of research exists that links each of the 23 modifiable drivers of health to either a material improvement in physical, mental, social, and/or spiritual function and/or to longevity. This is true despite the fact that less than 5 percent of modifiable drivers of health are defined consistently (or at all), captured systematically, and made broadly available as data. It is challenging to research what we do not measure well. This is also an important reason why much of the research demonstrates a correlation and does not fully prove causation.

Outside the matrix, we recognize that the evidence around nonconventional drivers is imperfect, and there is a great deal we don't know about how to optimize each. There is much less clarity around mechanisms of causality, the magnitude of impact that each driver has on each dimension of health, appropriate dosing, interaction effects, and how best to personalize. But outside the matrix, we view these gaps in knowledge as creating an imperative to invest dramatically more resources in researching and understanding these drivers, rather than as a rationale to discount them.

## 6. Achieving great health is as much about what we pursue as what we avoid

*Does eating with loved ones, spending time on meaningful activities, laughing, walking in the park, building new skills, and/or playing games that cause perspiration sound boring or painful?*

At some point while discussing health inside the matrix, someone will mention the quip, "You'll live to be a hundred if you give up all the things that make you want to."

The implication is that optimizing health requires sacrifices that are simply not worth it. From a systems perspective, the implication is that humans are so hardwired for "unhealthy" behaviors that large-scale change is unachievable, especially in the context of a consumer-driven economy oriented toward near-term hedonic enjoyment.

Outside the matrix, we understand that this sentiment is mostly false and highly fatalistic. It overemphasizes the benefits of avoiding what's harmful versus pursuing what's beneficial. It inaccurately pits short-term hedonic benefits against longer-term satisfaction.

Optimizing health requires some moderation of select activities, substances, content, food, relationships, etcetera. Valuing moderation itself is associated with strong health. It can be difficult to

[32] Yvonne Kelly et al., "Social media use and adolescent mental health: Findings from the UK Millennium Cohort Study," *eClinicalMedicine*, 2019, Volume 6.

[33] Hagai Levine, "Temporal trends in sperm count: A systematic review and meta-regression analysis of samples collected globally in the 20th and 21st centuries," *Human Reproduction Update*, 2022; Brenda Goodman, "Sperm counts may be declining globally, review finds, adding to debate over male fertility," CNN Health, November 18, 2022.

give up harmful habits, especially when reinforced by systems and culture.

But it is *more* true that optimizing health requires taking action and pursuing objectives that mostly result in near-term happiness and long-term well-being. A more constructive mindset is to emphasize the many beneficial and intrinsically rewarding aspects of optimizing health. Pursuing favorable actions also has the benefit of "crowding out" harmful behaviors.

In fact, optimizing *most* drivers of health is *mostly* about doing more of what people enjoy intrinsically so they can continue to do those things *longer*. This is terrific news. Eating healthy food, including with moderate alcohol, especially with loved ones, is enjoyable. Building stronger, healthier relationships is rewarding. Spending time in "flow" at work is rewarding. Sleeping well is rejuvenating. Most people enjoy some form of sport or physical activity as long as it is not labeled "exercise." Most people want to learn to cope with challenges more effectively. Most of the actions required to optimize longer-term health also have near-term physiological benefits like improved mood, energy, and performance.

## 7. People are more than patients; they deserve to be empowered with greater health literacy

*Who is the best steward of your health? What actions can you take to improve your own health or the health of people in your circle of influence?*

Inside the matrix, human health is primarily the responsibility of health ministers, healthcare providers, and the life sciences industry. Private payers, employers, and social institutions play important roles in select countries. Individuals are recognized as relevant but are thought of and treated as "patients." Merriam-Webster's dictionary defines a patient as "an individual awaiting or under medical care and treatment." Patients are passively "awaiting" and, by definition, engaged only when treatment is warranted.

Most people do not possess strong health literacy. In Europe, the most recent large-scale survey estimated that less than 20 percent of respondents self-assessed that they possessed excellent health literacy.[34] During the COVID-19 pandemic, 50 percent of adults in Europe reported not having the required competencies to take care of their health.[35] Moreover, few countries have made improving health literacy a priority.[36]

Outside the matrix, we conclude that in an increasingly complex world where day-to-day living is the primary determinant of health, individuals must be the long-term stewards of their own health. Recognizing the primacy of individuals does not in any way undermine the role of institutions, systems, and structures. It acknowledges the reality that in most cases there is no other person or institution with a commensurate level of information, incentive, or influence as an individual themselves.

Recognizing this reality should lead to more substantial investment and doing more to improve the health literacy of the world's population. Functioning well in modern societies requires acquiring a minimum health literacy threshold, but also knowledge across a range of disciplines including economics (for example, checking accounts, credit cards, mortgages), construction (for example, basic home repair), and technology (for example, computer usage). How can an individual steward their metabolic health without basic knowledge of energy balance, macro nutrients, and insulin? Health-literate individuals are better equipped to optimize their own health including making day-to-day trade-offs. They are more demanding customers of health-related products, services, and treatments. And they are more likely to demand and/or drive adaptations in public policy, employment, and other systems that positively affect their health.

[34] "Health literacy: The solid facts," WHO, 2013.
[35] Leena Paakkari and Orkan Okan, "COVID-19: Health literacy is an underestimated problem," *The Lancet*, 2020, Volume 5, Number 5.
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## 8. History suggests that the societal adaptations required to improve health are feasible; every person and institution on Earth has a role to play

*Did you ever think it possible that many billions of people would wear uncomfortable masks in public?*

Inside the matrix, the skeptic reminds us that achieving large-scale behavior change is difficult. They remind us that many aspects of modern life and consumer-demand-driven economies seem to be at odds with many actions required to optimize health.

Once we escape the matrix, however, we realize that humans are incredibly adaptable. We realize that large-scale behavior change is not only possible, it is normative over time.

To highlight just a few examples of large-scale changes in human behavior with a positive effect on human health, consider the following:

— In 1920, 1 percent of US homes had electricity and indoor plumbing. Indoor plumbing led to massive decreases in deaths from diarrhea, enteritis, and typhoid fever.[37]

— Prevalence of smoking among men has declined 50 percent or more in Japan, many European countries, and the United States over the past 50 years.[38]

— Mask wearing in public went from globally rare to common in several Asian countries in the 1990s, then to a near global norm during the COVID-19 pandemic.

— Seat belt usage increased from 14 percent in 1983 to 90 percent in 2016.[39]

— Nutritional fortification and supplementation have benefited billions of people.[40]

— Workplace injury, illness, and death remain unacceptably high but have fallen dramatically over the past one hundred years.[41]

We note that most of the favorable changes in human behavior typically involve a virtuous cycle of institutional and individual action. To this end, we believe every institution on Earth has a role to play in improving health literacy and adapting strategies, policies, and resources to help optimize health.

Once they escape from the healthcare matrix …

*Every government ministry,* including finance, education, agriculture, environmental, transportation, housing, energy, telecommunications, and commerce considers how to use its resources to positively affect drivers of health while developing strategies to improve health literacy.

*Every business* realizes it is in the business of health. They realize that most (if not all) of the products and services they offer do (or could) affect one of the modifiable drivers of health. They recognize that helping people optimize their health could be an attractive economic opportunity and positively affect society.

*Every employer* recognizes the profound impact that an employee's experience has on their health. The extent to which an employee finds meaning in their work, their physical experience, the nature of their work, their interpersonal interactions, the way in which they are developed (or not), the degree and stability of compensation and benefits, and an employer's policies and programming materially affect every modifiable driver of health. Employers

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realize that adapting to improve the health of their employees is both just and economically attractive.

*Every conventional healthcare stakeholder* embraces the need to modernize and adapt. They continue to innovate and improve the ability to detect, treat, and cure disease with conventional interventions. They also embrace that they are in the best position to define, measure, and promote an understanding of health that is holistic and anchored in function. They commit to defining and promoting optimal health and to better understanding and applying insights from nonconventional drivers of health. They fundamentally recognize that empowering individuals must be the foundation of our health systems. As such, they lead by example in improving health literacy and supporting individuals.

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*Authors' note: We close by reaffirming our gratitude for the millions of people dedicated to improving our health. You literally save our lives every day.*

*We invite you and every other reader to venture outside the healthcare matrix, to aspire to great health and act more decisively. It may be uncomfortable, but we believe dramatic improvements in human health are possible if we act. And we want to hear from you! Follow and share your thoughts with us on LinkedIn. Subscribe to receive communications from MHI.*

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Table

# The healthy 23: Drivers of your health and longevity

December 2022

**Modifiable drivers of health heavily influence overall health status.** A large and growing body of evidence suggests that out of 23 drivers, 19 reside outside of traditional healthcare systems. Each of these drivers appears to have an independent, direct, material, and causal impact on health and longevity. What's more, these drivers are modifiable.

| Drivers | Description | Illustrative highlights |
|---|---|---|
| *Physical inputs* | | |
| Diet | Food selection; portions; preparation; eating timing; macro/micro nutrients; fasting/calorie restriction; water consumption | • Fasting has shown the ability to reverse Type 2 diabetes and reduce the likelihood of cognitive decline[1]<br>• Emerging research is demonstrating that ketogenic diets can help treat serious mental illness[2]<br>• A range of healthy diets has been shown to reduce risks of disease, extend life, and improve mood[3]<br>• A Mediterranean diet including olive oil and nuts is associated with a 30% lower risk of cardiovascular disease[4]<br>• Drinking 1–2 sugar-sweetened beverages per day is associated with a 14% higher risk of mortality from any cause[5]<br>• Higher blood glucose levels in nondiabetic patients is associated with 30–40% higher likelihood of cardiovascular and cancer-related death[6] |

| Drivers | Description | Illustrative highlights |
|---|---|---|
| *Physical inputs (continued)* | | |
| Supplementation | Frequency; extent of use; type (eg, extracts, teas, vitamins, minerals, herbs, botanicals, amino acids, metabolite, probiotics, caffeine) | • Multiple studies have found DHA and EPA supplementation (fish oil) lowers risk of cognitive decline, especially among people at high risk for Alzheimer's disease, and is linked to 13% reduced risk of heart attacks[7]<br>• Drinking 1–4 cups of coffee per day is associated with a lower mortality risk of 12–17%[8]<br>• Despite having enough food, 2 billion people do not get enough micronutrients (eg, up to 500,000 children who lack vitamin A become blind every year)[9]<br>• Vitamin D supplementation reduced the risk of death from cancer by 15%[10] |
| Substance use | Frequency; extent of use; type (eg, alcohol, tobacco/nicotine, vaping, cocaine, marijuana, heroin, psilocybin) | • Smokers who stop smoking at age 40 can recover 9 of 10 years lost due to lifelong habit[11]<br>• Drinking >17 units of alcohol a week has been linked to accelerated DNA aging, cognitive decline, and cardiovascular disease[12]<br>• When used in a time-bound and appropriately dosed manner, oral cannabinoids have been shown to reduce chemotherapy-induced nausea by up to 38 percent[13] |
| *Movement* | | |
| Mobility | Mix of time by position; standing, sitting, walking, posture, typing, neck position, use of fine motor skills | • Dozens of studies demonstrate that walking reduces chronic pain, strengthens the immune system, and significantly decreases anxiety, sadness, and fatigue[14]<br>• Numerous large observational studies show a strong link between walking and all-cause mortality[15]<br>• In 2019, 15 million years of life were lost or lived with disability because of occupational ergonomics (matching workplace conditions and infrastructure to suit human factors such as posture)[16] |
| Exercise | Duration; frequency; type (eg, sports, endurance, high intensity, strength/ resistance, stability, flexibility, coordination, individual/group) | • Extensive robust research shows that consistent exercise alone can extend life by 3–5 years and improve quality of life by 5–10 years[17]<br>• Burning 1,000 calories a week can reduce mortality by 20%[18]<br>• A study found that people over age 60 who participated in weekly balance and resistance training showed a 34% reduction in falls[19]<br>• People with poor fitness (25th percentile of $VO_2$ max) have a mortality risk 2.75× higher than those with high fitness (75th percentile)[20]<br>• High-intensity activity for a relatively short period of time appears to stimulate brain growth in older adolescents [21] |
| Sleep | Quality; duration; mix by stages; regularity; consistency; alignment to circadian rhythm | • Sleep quality, duration, and consistency are associated with better academic performance in college students[22]<br>• Sleeping <6 hours vs 7–9 hours a night is associated with an all-cause mortality increase of 13%[23]<br>• 2 weeks of 4 hours of sleep per night results in a ~50% reduction in ability to process glucose[24]<br>• Sleeping >9 hours a night has been associated with lower cardiovascular health[25]<br>• Insomnia is linked to increased risk of cognitive impairment by 27%[26] |

| Drivers | Description | Illustrative highlights |
|---|---|---|
| *Daily living* | | |
| Productive activity | Work, volunteering, caregiving, hobbies, worshipping, activism, playing music, arts/ crafts, travel | • Multiple studies have found that more engaged employees experience better physical and mental health[27]<br>• Laid-off workers in the US were found to be 54% more likely to have fair or poor health, and 83% more likely to develop a stress-related condition, such as stroke, heart attack, heart disease, or arthritis[28]<br>• There is a strong correlation between health (including longevity) and engagement in altruistic activities (eg, people who volunteer have fewer symptoms of depression, anxiety, and stress-induced pain compared with non-volunteers)[29] |
| Social interaction | Conversations, meals, vocational interaction, friendships, physical intimacy, marriage/ dating, activities; in-person or remote | • Dozens of studies have observed an average 50% increased likelihood of survival for participants with stronger social relationships[30]<br>• Social integration during childhood is related to blood pressure and BMI in adulthood[31]<br>• Sports with more inherent social interaction (tennis, badminton, soccer) are associated with greater longevity gains than other sports[32]<br>• Owning a pet is associated with decreased risk of cardiovascular disease[33] |
| Content consumption | Entertainment, literature, news, music, pornography; all formats—online, apps, social media, newspaper, in-person, TV, gaming | • Consuming pornography for >30 minutes in a row is linked to a higher prevalence of erectile dysfunction[34]<br>• >5 hours' daily use of social media was associated with a 35–50% increased risk of depressive symptoms in adolescents[35] |
| Hygiene | Handwashing, bathing, showering, oral care, ear protection, grooming | • Washing hands with water and soap reduces by 50% the risk of spreading diarrheal disease[36]<br>• Personal hygiene significantly impacts our risk of infection and affects our mental health (eg, poor oral health can exacerbate social withdrawal, isolation, and low self-esteem). It can also cause problems with speaking and eating and is correlated with higher mortality for older adults[37] |
| *Exposure* | | |
| Nature | Time among forests, flowers, bodies of water, wildlife/insects, mountains; day/night sky | • Exposure to nature, or higher levels of greenery, lowers levels of depression, increases motivation for physical activity, and can lower the risk of respiratory disease[38]<br>• Death from respiratory disease is reduced by 33% in women who have high levels of vegetation in their homes[39]<br>• A recent random control experiment demonstrated that exposure to nature for 30 minutes–1 hour reduced stress and improved the brain's ability to successfully navigate future stressors[40] |

| Drivers | Description | Illustrative highlights |
|---|---|---|
| *Exposure (continued)* | | |
| Atmosphere | Temperature; humidity; weather, weather events; radiation; smoke; high heat/cold exposure (sauna, cold plunge) | • Multiple studies show that regular use of saunas at high temperatures decreases the risk of all-cause mortality by as much as 40% and the risk of dementia as much as 66%[41]<br>• Worldwide, air pollution causes 7 million deaths annually, of which 3.2 are due to indoor air pollution (eg, cooking with solid fuel)[42] |
| Sensory | Screens; sun/exterior light; type/degree of interior light; noise: type, intensity, duration | • Regular exposure to sunlight can avoid a decrease in a hormone that can trigger depression symptoms (seasonal affective disorder)[43]<br>• Noise pollution leads to 12,000 premature deaths a year in the EU, mostly through a link with heart attacks and diabetes[44] |
| Materials | Type (air, water, surfaces, fabrics, containers); contents (toxins, germs, pollutants, heavy metals, allergens) | • Research suggests weighted blankets may benefit people with anxiety, pain and autism[45]<br>• Exposure to toxins from consumer products, even cheap jewels, can cause physical damage[46]<br>• Globally, lead exposure is estimated to account for 30% of intellectual disability without a known cause[47]<br>• A study associated children who had high exposure to pesticides with a 7-point IQ drop compared with children who had low exposure[48] |
| Stress | Response to physical, emotional and/or mental challenge (pressure, trauma, excitement); acute and chronic; includes eustress | • Eustress, or favorable stress, including time in "flow," is associated with stronger cognitive function, resilience, and improved immune function[49]<br>• Chronically elevated levels of stress can increase the risk of cardiovascular disease, neurodegenerative disease, and metabolic disease[50]<br>• *The Lancet* recently reported that individuals have a 3× increased risk of mortality the year they are diagnosed with a stress-related disorder[51] |
| *State of being* | | |
| Mindsets/beliefs | Attitudes/perspectives toward all aspects of life: religion/ philosophy, optimism, agency, nature of people, purpose, hope | • Optimists (a learned behavior) are 35% less likely to experience a cardiovascular event compared with pessimists[52]<br>• A study by the University of Kentucky demonstrated that immunity is stronger in individuals with positive thoughts, even if they are healthy[53]<br>• A randomized, controlled trial of 4,000 children demonstrate that 30 minutes of training around a "growth mindset" had strong and lasting positive effects on mental health and academic performance[54]<br>• Multiple studies highlight an association between gratitude and better physical health, more friends, stronger resilience, reductions in depression, and better sleep[55] |
| Body composition | Body fat by type of fat; lean muscle mass; morbid obesity | • Increasing lean muscle mass can improve metabolic function across all age groups and prevent falls in the elderly[56]<br>• Excess body fat accounted for 120 million years lost to disability or premature death; 37% of the years lost occurred among nonobese individuals[57]<br>• Visceral fat is most closely linked to health span and longevity[58] |

| Drivers | Description | Illustrative highlights |
|---|---|---|
| *State of being (continued)* | | |
| Physical security | Physical security/ safety: absence of war, armed conflict, criminal violence, domestic violence, avoidable accidents | • Exposure to violence and breaches to safety have long-term effects on health. Between 1990–2017, war contributed to an extra 29 million civilian deaths[59]<br>• 1.7 billion people are exposed to temperatures and humidity that can be deadly[60] |
| Economic security | Food security, housing security, income security, access to healthcare | • High-income individuals are 5× more likely to self-report strong health[61]<br>• The rising cost of living has adversely impacted population health. In 2021, >6,000 deaths in England were directly attributable to fuel poverty[62]<br>• Impoverished conditions can permanently alter a child's brain architecture and increase risk of developing chronic illnesses[63] |
| *Healthcare* | | |
| Vaccination | Regularity and extent of vaccination: measles, mumps, rubella (MMR); flu; COVID-19; tuberculosis; polio; tetanus | • In 2021, COVID-19 vaccinations are estimated to have prevented 14.4 million deaths worldwide[64]<br>• The polio vaccine spared 16 million from paralysis since 1998 and has achieved 99.9% of polio eradication[65] |
| Detection/ diagnosis | Monitoring; testing; screenings; genetic testing; diagnosis of risk factors, disease and/or conditions | • Advancements in diagnosing disease has enabled us to halt progression of disease and prevent death from malignancy[66]<br>• In the UK, cervical cancer screening every 5 years was found to have reduced deaths from cervical cancer by 70%[67]<br>• A study conducted by the Office for National Statistics shows that for most cancers, survival at 1 and 5 years is much higher if the cancer is detected early (at stage 1) (eg, for colorectal cancer, 1-year survival if detected at stage 1 is 97.7%, falling to only 43.9% if detected at stage 4)[68] |
| Clinical intervention | All forms of clinical treatment: surgeries, device implant, pharmacologic; therapy; hearing aids; other medical devices | • 5-year cancer survival rates in the US have increased from 50% in the 1970s to 67% by the 2010s, including for cancers detected late, due to improved treatments[69]<br>• HIV medication has saved 16.5 million lives since 2001[70] |
| Adherence | Extent to which an individual follows a prescribed treatment plan including interventions, extent, frequency, duration, method | • A 25% decrease in adherence to inhaled steroids for asthma doubles the rate of asthma-related hospitalization[71]<br>• 200,000 premature deaths in Europe per year are due to poor adherence, and mortality rates for patients with diabetes and heart disease who don't adhere to medication are nearly twice as high than for those who do[72] |

*Disclaimer: Drivers of health are complex. Effects can vary among individuals based on genetics, traits, randomness, and interaction with other drivers. Each driver can be optimized (or not) based on a myriad of individual choices and structural/environmental influences.*

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