

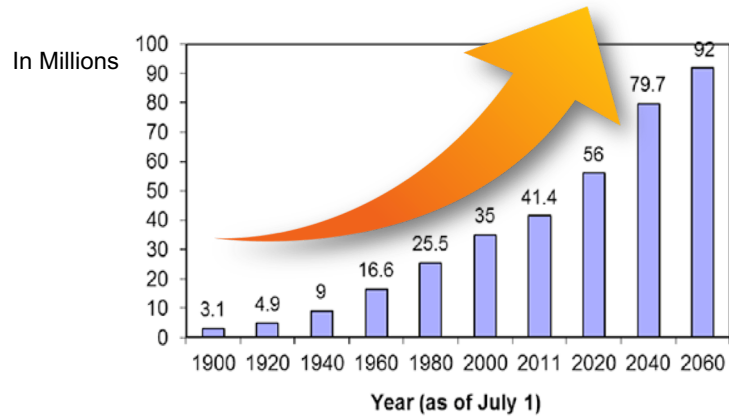
# Smart Health – CSE 40816

University of Notre Dame  
Spring 2020



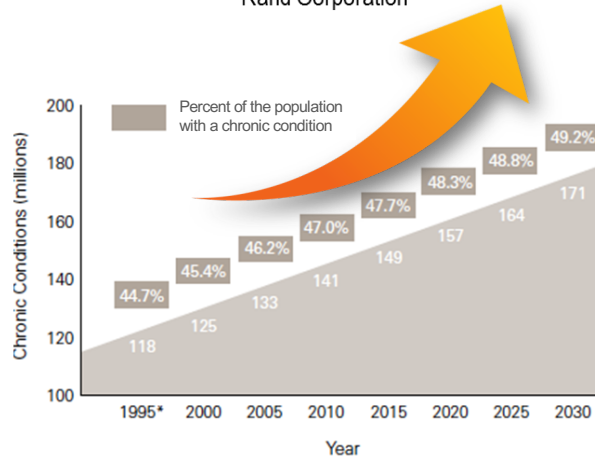
## Chronic Conditions (Non-Communicable Diseases)

Number of persons 65+ (1900-2060)  
Administration of Aging

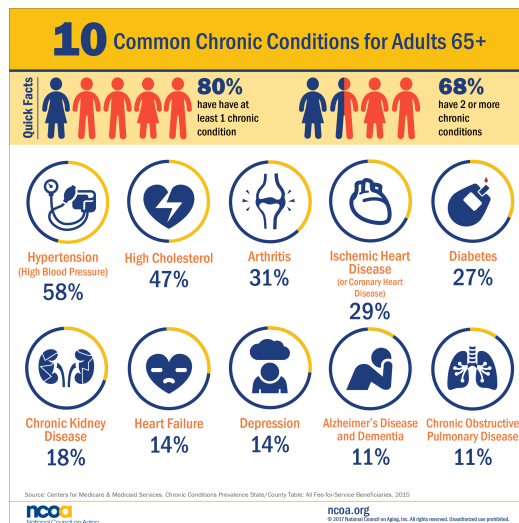


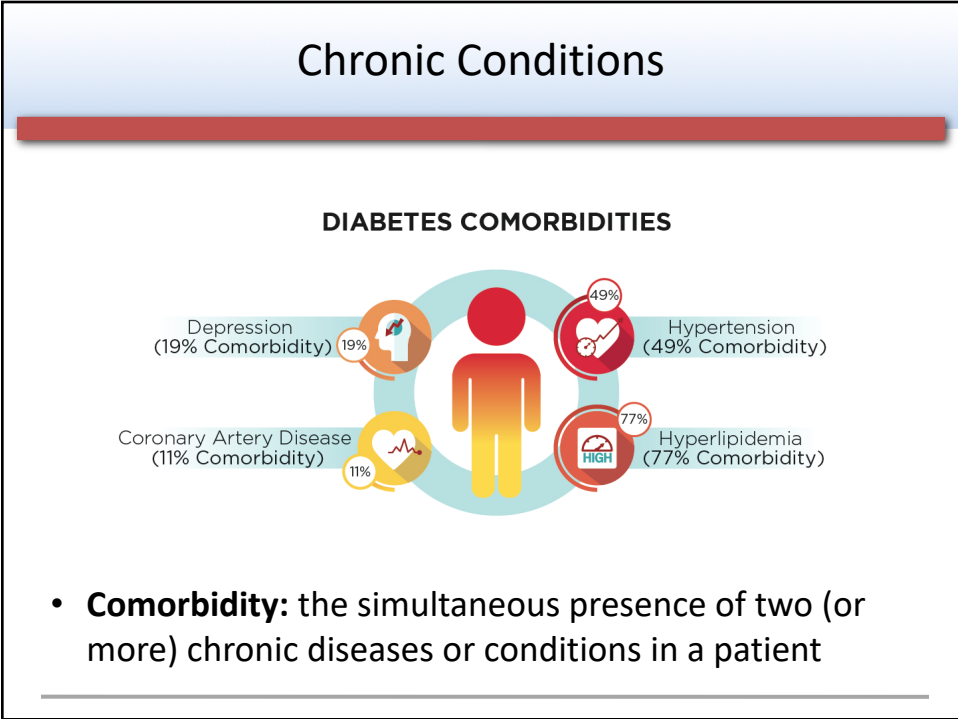
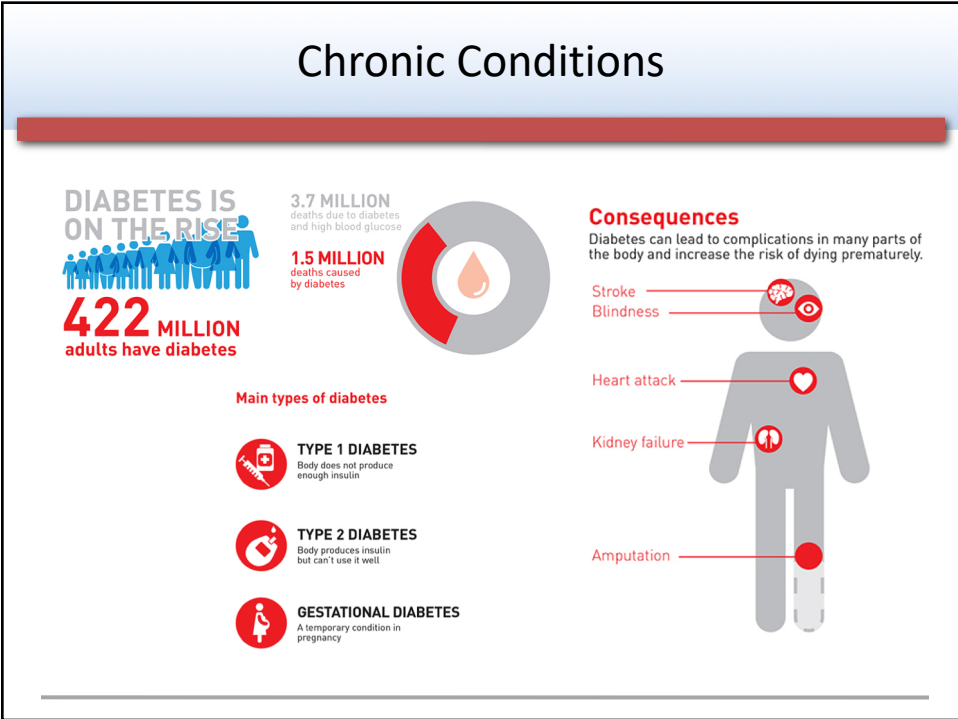
## Chronic Conditions

**Number of people with chronic conditions**  
Rand Corporation

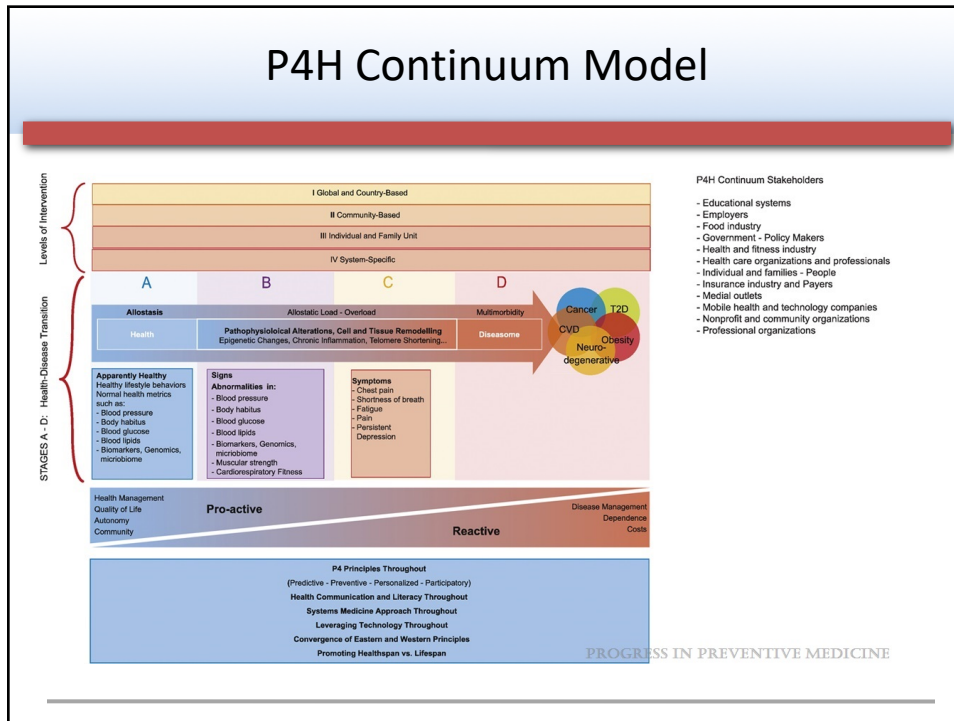


## Chronic Conditions



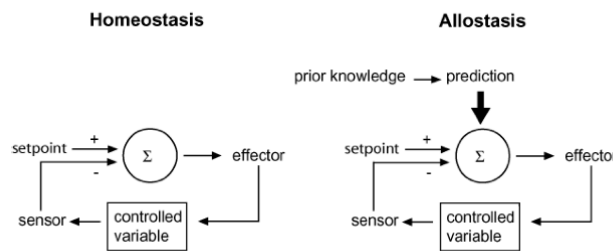


# P4H Continuum Model



# Allostasis vs. Homeostasis

- **Homeostasis:** state of steady internal physical & chemical conditions
- **Allostasis:** process of maintaining homeostasis in response to environmental and physiological stress

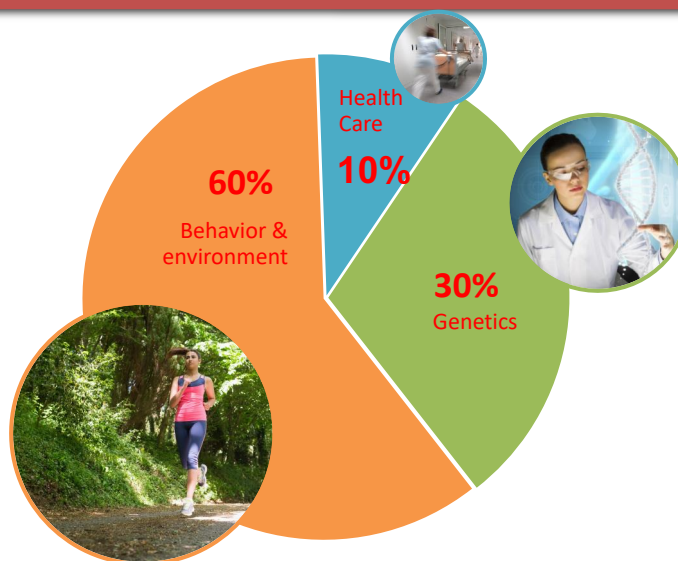


**Figure 1. Alternative models of regulation.** *Homeostasis* describes mechanisms that *hold constant* a controlled variable by sensing its deviation from a “setpoint” and feeding back to correct the error. *Allostasis* describes mechanisms that *change* the controlled variable by predicting what level will be needed and overriding local feedback to meet anticipated demand.

## Allostasis vs. Homeostasis

- **Example:** controlling body temperature
  - Homeostasis: too hot/cold: sweating/shivering to cool/warm body
  - Allostasis: dehydration leads to changes in sweat levels, kidney function, eye/nose mucus production, ...
- **Allostatic load** is “the wear and tear on the body” which accumulates as an individual is exposed to repeated or chronic stress.

## Determinants of Health in U.S.



## Signs vs. Symptoms

- **Signs** and **symptoms** are abnormalities that can indicate a potential medical condition
- Whereas a **symptom** is subjective, i.e., apparent only to the patient (e.g., back pain or fatigue), a **sign** is any objective evidence of a disease that can be observed by others (e.g., a skin rash or lump)

## Stressor

- A **stressor** is a chemical or biological agent, environmental condition, external stimulus, or an event that causes stress to an organism
- Examples: physical inactivity, poor nutrition, distress and trauma, excess body mass, pollution (water, air, noise), tobacco use, drug use, inadequate sleep, socio-economic stress, ...

## Interventions

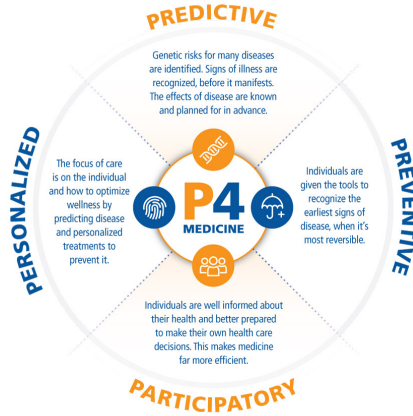
- **Level I: Global/country (“public health”)**
  - Legislation, health-promoting initiatives, policy reports, recommendations, ...
- **Level II: Community**
  - Healthy lifestyle environments, access to healthy food, physical activity, smoke free environments, etc.
  - Community includes social networks
- **Level III: Individual/family**
  - Participatory; interactions with all kinds of health professionals, etc.
- **Level IV: System-specific interventions**
  - Targeting a specific physiological system
  - Pharmacologic interventions, surgery, etc.
  - “Reactive” healthcare; stages C & D

## P4 Principles

- **Predictive:**
  - Predict an increased likelihood for adverse events
  - Prevention & early intervention
- **Preventive:**
  - Eliminate risk factors
  - As opposed to treatment
- **Precise (Personalized):**
  - Moving away from generalized healthcare
  - “Customization” of healthcare
- **Participatory:**
  - Moving away from “top-down approach”
  - Engage patients

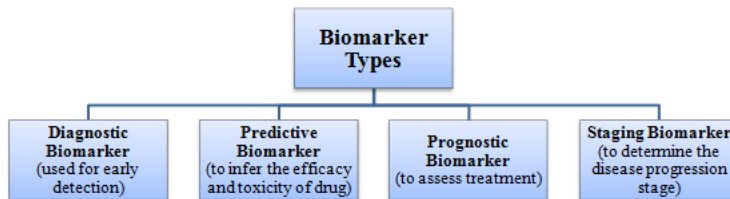
# P4 Principles

Scientific wellness embodies  
**P4 MEDICINE:**



# Biomarkers

- Measurable indicator of some biological state or condition





## Reactive vs. Proactive Healthcare

- Current medical field focuses primarily on care after illness

