Health systems as complex adaptive systems

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What is a system

A system can be defined by the coming together of parts, interconnections, and purpose

The parts of a system are interesting on their own, but what matters is how they come together and are interconnected.

Thermostat

Consists of various independent parts, which are interconnected to achieve a specific purpose (maintaining a desired temperature).

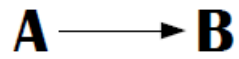
Health system

Consists of various independent parts (clinics, pharmacies, laboratories), which are interconnected (through patient flows and information) to achieve a specific purpose (maintaining and improving health).

What is the difference between a health system and a thermostat?

It is possible to predict what each part will do in response to a given stimulus.

One can study the system in great detail and predict how it will behave under different circumstances.



The "parts" (people) have the freedom and the ability to respond to stimuli in unpredictable ways.

Such behavior can be for better or for worse, leading to innovation or to error.

It is impossible to predict the behavior of the system.

What happens when you treat a health system like a thermostat?

“System designers” often “construct” complex human systems as if the behavior of the parts and interconnections were predictable, when in fact they are not.

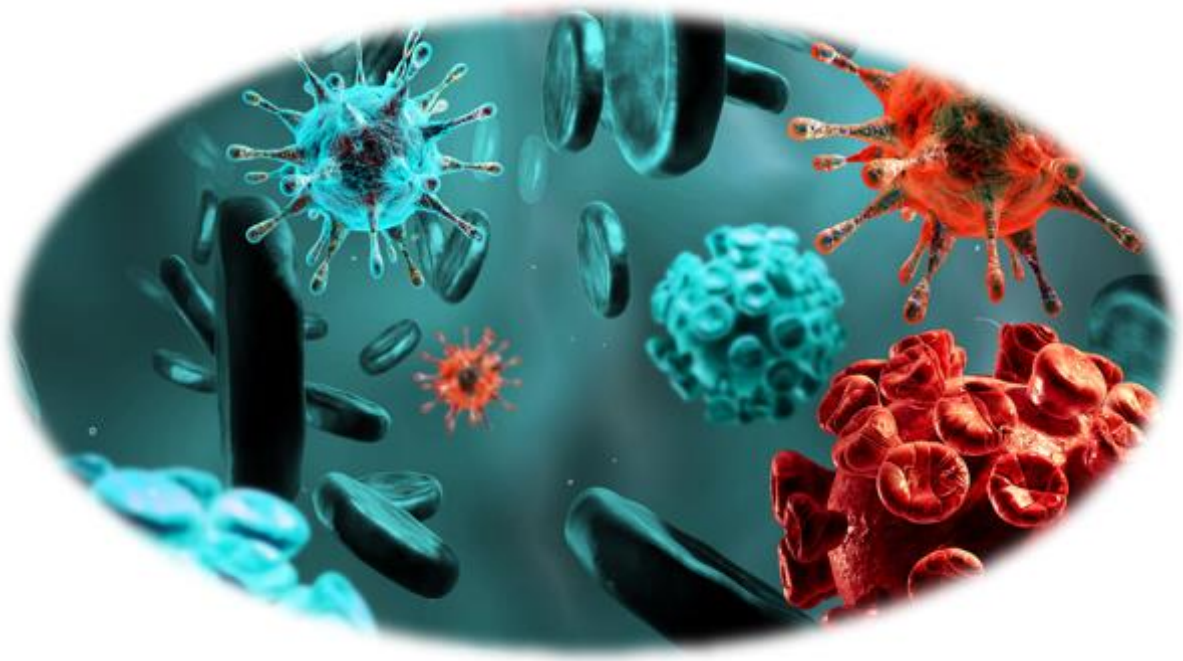
«When the human parts do not act as expected or hoped for, we say that people are being “unreasonable” or “resistant to change,” their behavior is “wrong” or “inappropriate.” The system designer’s reaction typically is to specify behavior in even more detail via laws, regulations, structures, rules, guidelines, and so on. The unstated goal seems to be to make the human parts act more mechanical.»

Paul Plsek «Redesigning Health Care with Insights from the Science of Complex Adaptive Systems». 2001.

Complex adaptive system

A complex adaptive system (CAS) is a set of agents, each acting freely and not always predictably. They are interconnected: the actions of one change the context for others.

Example:
The human immune system



Properties of a complex adaptive system

Adaptable Elements

Elements of the system can change on their own

Antibiotic-resistant bacteria; a person in the process of learning

Simple Rules

A few simple rules, applied locally, can lead to complex outcomes

Traffic rules; a starling flock (each bird follows three rules – stay together, avoid collision, mimic neighbors)

Nonlinearity (the butterfly effect)

Small changes can have large effects

An avalanche (snow rests quietly for decades but one step of a skier leads to a massive collapse); a large-scale corporate program may yield no result, while a random rumor can trigger real change

Emerged behavior, novelty

Constant creativity is the natural state of the system

Ideas emerging in the mind; behavior of the stock market

Properties of a complex adaptive system

Unpredictability, especially in detail
Since elements are changeable, relationships are nonlinear, and behavior is unexpected, the only way to find out what a CAS will do is to observe it
Weather forecasting

Inherent Order
Systems can be ordered even without centralized control. Self-organization
An anthill; the stock market; the internet

Context and embeddedness
Systems exist within systems
Organs within a body; streams and tributaries forming a river basin

Coevolution
Tension and equilibrium
Host-parasite coevolution; competition between companies

Paradoxes of a complex adaptive system

- We cannot know in advance what the system will do or how to optimize it
- Relatively simple rules can lead to complex, innovative system behavior
- Managing a complex adaptive system does not have to be complicated. **The solution is to create conditions for self-organization through simple rules that allow for adaptation**

Health systems are complex adaptive systems

Elements of the system can change on their own
Opening an endoscopy unit reduced waiting lists and eased the workload of the surgical inpatient department.

Simple rules can lead to complex outcomes
The rule "wash hands before entering a patient's room" stopped an outbreak in the ward.

Small changes can have large effects
A cleaner moved the water cooler into the hallway and doctors became less tired and made fewer errors.

Constant creativity and novelty
A nurse suggested colored wristbands for patients with allergies and, within a year, they were used across the entire region.

Health systems are complex adaptive systems

Unpredictability, especially in detail
They calculated the number of beds but the ambulance brought thirty people with food poisoning in one hour.

Can be ordered even without centralized control
During resuscitation, everyone knows what to do without any commands.

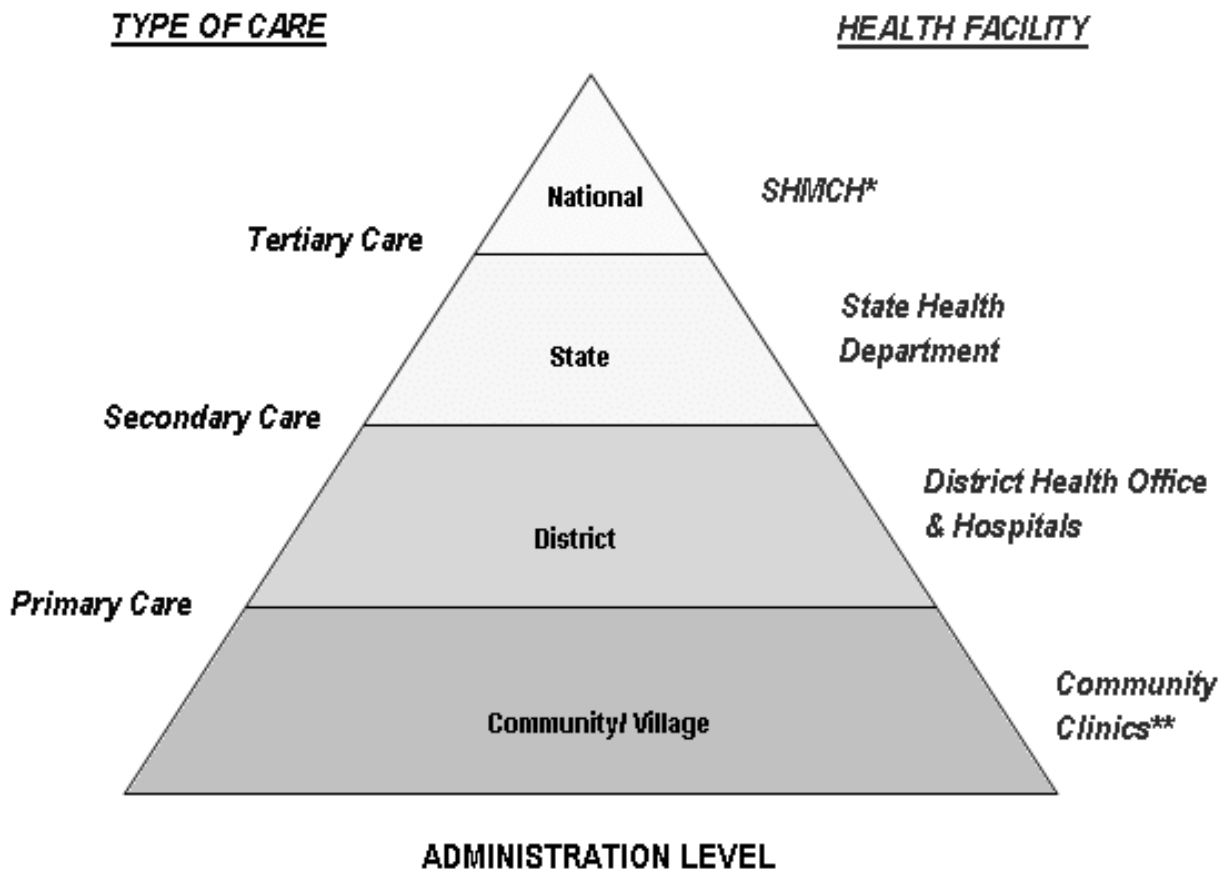
Systems exist within systems
An emergency department is part of the hospital, the hospital is part of the district network, the district network is part of the national system.

Coevolution
Patients got used to receiving test results via chat and the laboratory had to officially adopt this channel.

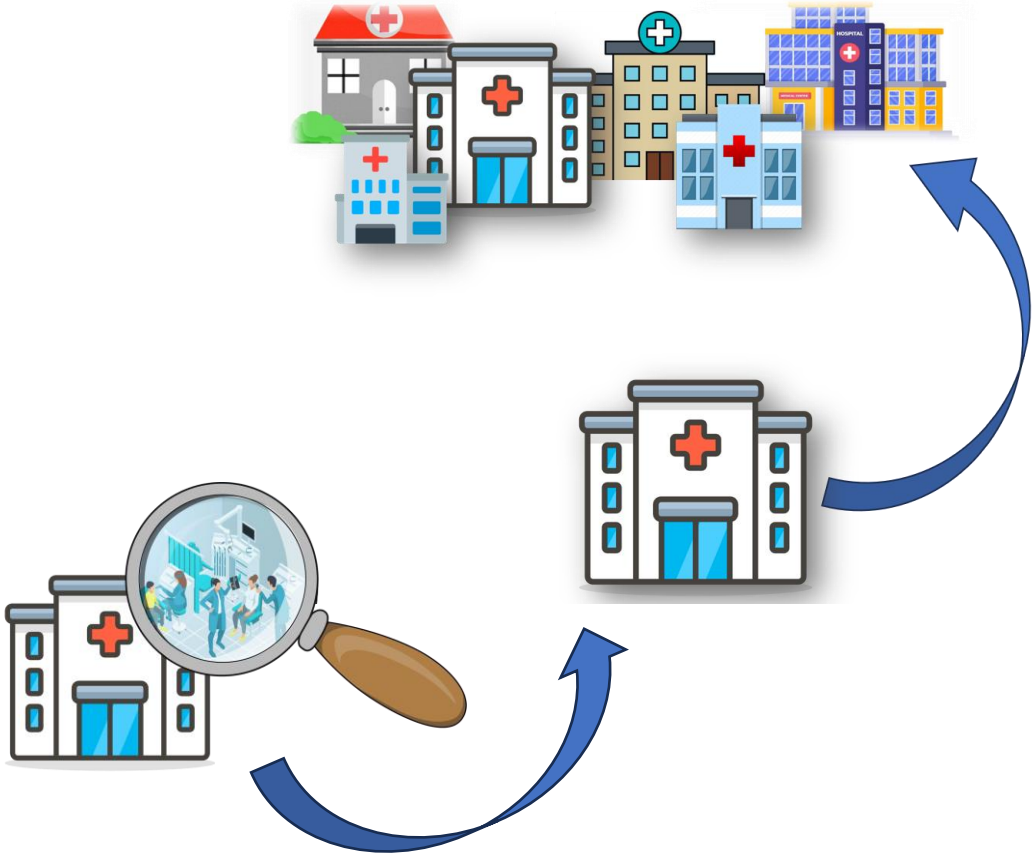
How to manage a health system
in the context of a complex adaptive system?

– To create conditions for self-organization
through simple rules that allow for adaptation

Hierarchy in healthcare: what is more important?

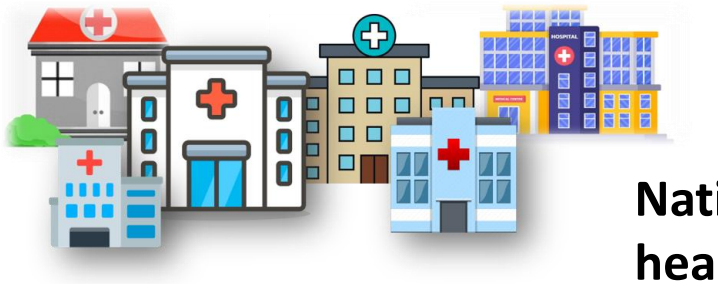


Hierarchy in healthcare: what is more important?



The question is not about the level of hierarchy but about the level of detail

Levels of detail



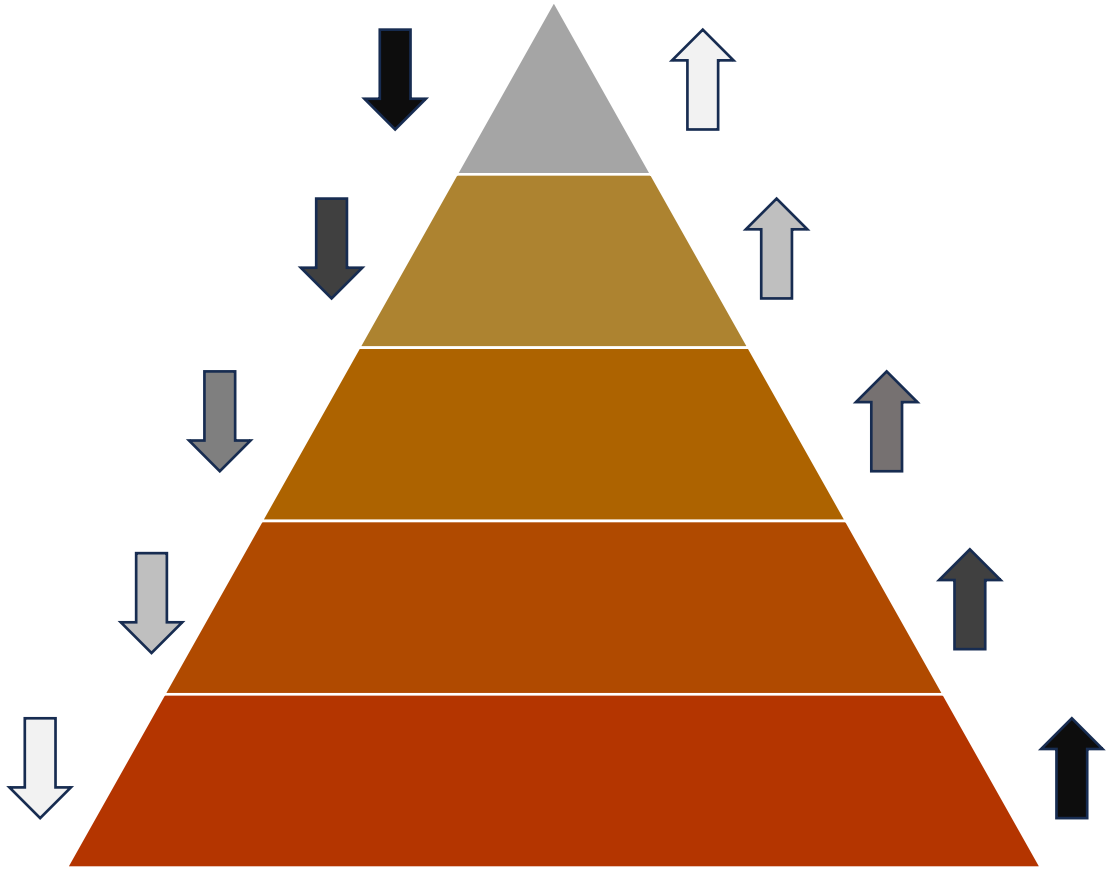
National healthcare system – **it is a health system**

Hospital – **it is a health system**

Department – **it is a health system**

Rigid hierarchy

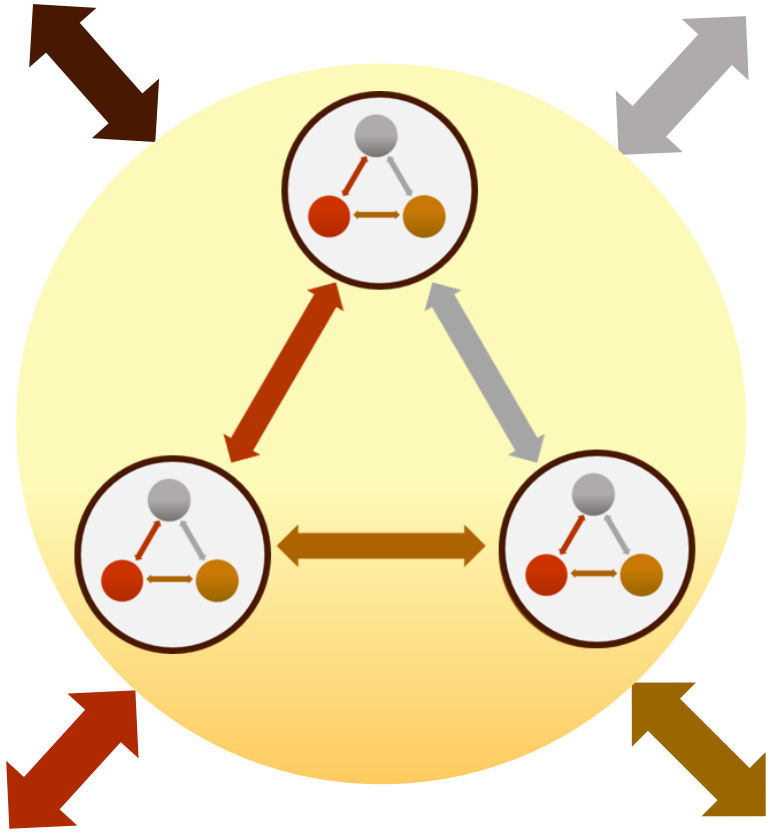
Instructions
flow
from the top down
and are modified
at each level



Feedback
passes through all
levels
and does not always
reach leadership

Network interactions and different levels of detail

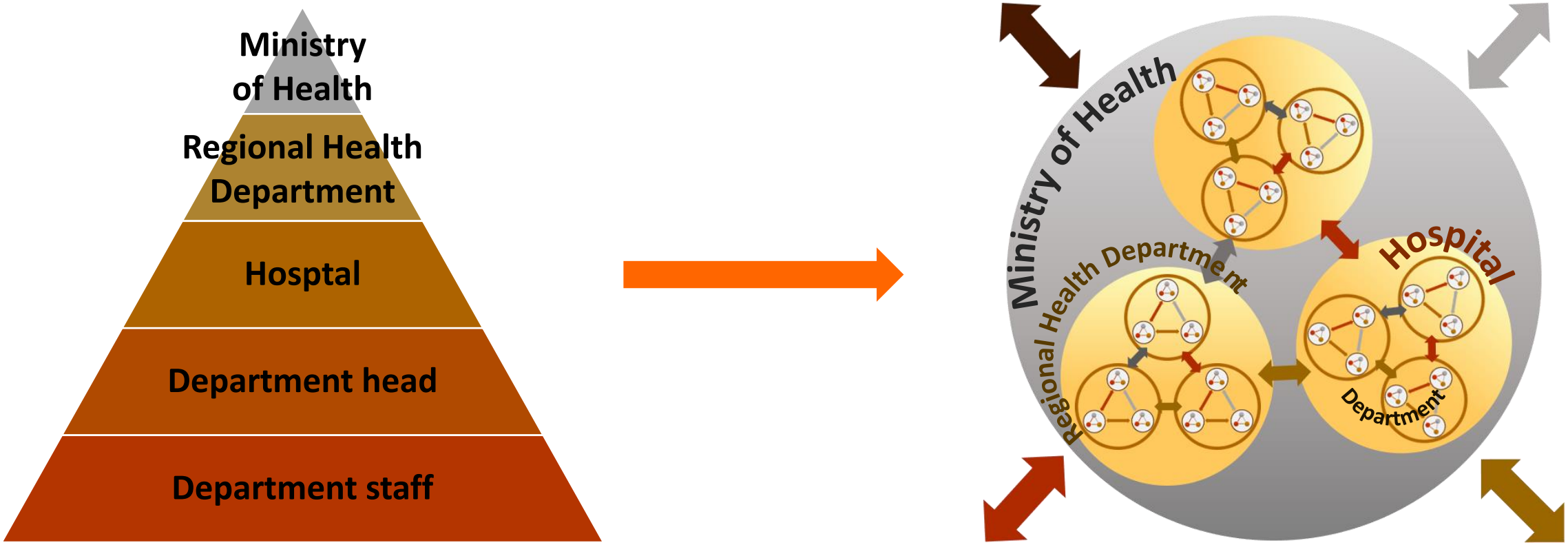
Instructions
are given according
to the function of
each level



Feedback
is given to those who can
actually change the situation.
Leaders are facilitators rather
than commanders

Decision-making authority belongs to the level where the information resides

From rigid hierarchy to network interactions



We "turn the pyramid sideways": the rigid vertical becomes a network
All decisions remain within the responsibility of their own level
Communication becomes more flexible and faster

From rigid hierarchy to network interactions
Advantages of the approach

- Authority is distributed more evenly across levels
- Most management happens within each level
- Decisions are made where the information resides
- Feedback loops are closed at the same level where decisions are made
- The path between instruction and execution is shortened
- The path between leadership and the patient is shortened
- A change in leadership does not collapse the entire system

What else is needed for a system to function at its best?

- Creating conditions for achieving results rather than demanding results
- Managing through simple rules, not rigid orders
- Encouraging diversity: of opinions, knowledge, work models
- Recognizing achievements rather than hunting for weaknesses
- Monitoring system indicators (delayed morbidity, staff burnout, patient trust) rather than KPIs
- Adaptive leadership: everyone is a director in their own role

Conclusion

- A health system at any level (department, hospital, regional, national) is a complex adaptive system.
- Its behavior cannot be predicted in detail. But we can create the conditions for it to manage itself.
- A few simple rules are enough. The rest, the system will build on its own.
- Circumstances change and the system learns from its mistakes and adapts.
- Complex order emerges on its own, without central planning.
- A network structure simplifies management. Communication between levels is just as important as communication within a level.

And one more thing:

“There are no permanent solutions in a dynamic system”

Naval Ravikant

References

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