Introduction

The world we live in is a complex system composed of subsystems that interact among each other with each having clearly defined boundaries and coherent dynamics. Systems theory was developed by biologist Ludwig von Bertalanffy in the 1930s to simplify world complexity to human mind and make it more understandable (von Bertalanffy, 1962). The development of the theory came as a result of the author's perceived need for a theory to guide research in multiple fields. His theory helped to provide a common framework that created shared and common language that scientists from different disciplines can use to communicate their findings. Simply put, systems theory is used to understand how things around us work.

Systems theory looks at the world as a system composed of smaller subsystems. Systems as a representation of life phenomena are used by humanity in every day life to describe the functioning of these phenomena. For example, a hospital is a system with inputs, processes and outputs. The hospital itself is a component of a larger system, health care system. The health care system, banking system, educational system, judicial system and other systems comprise the socio-economic-political system within which we live.

Significance of Systems Theory to Health Care Management

Systems theory can be used to clearly and concisely understand health care structures, processes and outcomes processes and their interactions within a health care system. Systems theory can be used as a framework to describe the components of systems and the relationships between these components, the boundaries of the system, the goals of the system, and system's ability to change and adapt in response to internal and external forces. Systems theory and thinking can help us understand how health care organizations and systems behave and it allows us to clearly assess, visualize, analyze and understand the structure, processes, and feedback loops that make up the organization. This correct and clear understanding of the organization as a system is a necessity to be able to manage organizations effectively and efficiently and to achieve organization's goals.

System Definition

A system is a collection of independent but interrelated elements or components organized in a meaningful way to accomplish an overall goal. The function of any system is to convert or process materials, energy, and/or information (inputs) into a product or outcome for use within the system, or outside of the system (the environment) or both.
Definition of Key Terms

Inputs include raw material, energy and resources processed to produce the outputs of the organization. Examples include information, money, nurses' effort, physician's time, fuel, energy, time, individual effort, & any raw material of some kind.

Elements or components are the things, parts, or substances that make up the system. These parts may be humans, material, equipment, etc. Elements have attributes or characteristics that can be measured or described such as size, color, volume, quantity, temperature, and mass.

Throughput is the processes used by the system to convert raw materials or energy (inputs) from the environment into products or services that are usable by either the system itself or the environment. Examples include, thinking, physical examination of patients, diagnosing, planning, decision-making, writing prescription, taking vital signs, operating on a patient, constructing, sorting, making a speech, sharing information, meeting in groups, discussing, melting, shaping, hammering, etc.

Output is the product or service which results from the system's throughput or processing of technical, social, financial & human input. Examples include health services, better health, software programs, documents, decisions, laws, rules, money, assistance, cars, clothing, bills, etc.

Feedback is information about some aspect of data or energy processing that can be used to evaluate & monitor the system & to guide it to more effective performance. How many patients were are seen in 2 hours clinic? How man medical errors were committed in a hospital? Why were mistakes made? HealthCareReportCard.com is an example of how hospitals are doing with certain diagnoses. Hospital accreditation reports are an example as are patient satisfaction surveys, sales reports, and test results.

Subsystem is a system which is a part of a larger system. They can work parallel to each other or in a series with each other. Information system is an example of a subsystem in a hospital. Medical staff as an organization is a subsystem of the hospital.

Dynamic system is any system that continuously influences and changes its environment and is being influenced and changed by its environment. Dynamic systems are usually composed of components that are structured and interrelated in such a way that a change in one component necessarily affects other components of the system. A hospital in Amman is an example of a dynamic system where it influences and changes its environment (health, quality of life) and is being influenced by its environment (restructuring to provide new needed services). On the other hand, a static system is defined as any system that does not change over time in relation to environment. To survive, systems are better off being dynamic rather than static. Evidence based practice in health care is an example of how health care services are dynamic and not static.
Open system is defined as a system that interact with its environment exchanging raw materials and energy for services and/or goods produced by the system. Health care facilities, hospitals, families, humans, cardiovascular system, banks, etc are examples of open systems. A hospital produces health services through practice, health care professionals through training and knowledge through research. In return it receives money, raw materials, appreciation, and energy from its environment.

Any system must have a goal. The goal is the overall purpose for existence of the system. Examples include; treating patients, to educate student nurses, to produce knowledge, to manufacture candy, to make coffee, and so on.

System Characteristics
Most systems have the following common characteristics:

- All systems have common elements. These are input, throughput or process, output, feedback, control, environment, and goal.
- Systems have varying degrees of complexity.
- The organized components of a system comprise a unified whole that is greater than the sum of its components.
- To be viable and successful, a system must be goal-directed, able to adapt to changing environment, technology and circumstances, and be governed by feedback and must value continuous leaning and development, creativity and innovation. And to survive, a system must save some of its output to maintain itself.
- The structure of systems is defined by its components (parts) and processes.
- Various system components have functional and structural relationships between each other and are organized in a way to accomplish a specific function or set of functions.
- Systems often exchange material, information and/or energy beyond its boundary with other systems, through input and output processes.
- To be part of the system any element must have a relationship with at least one element of the system. Any element which has no relationship with any other element of the system cannot be a part of that system.

Organization as a System

Human social groups (organizations) exist and interact to produce, consume and exchange goods and services. It is helpful for understanding to think of organizations as systems. A system is an organized collection of independent but interrelated elements or components to accomplish an overall goal. Simply put, an organization as a system has various inputs that are processed to produce outputs. A continuous feedback between the different components of the system ensures that the system is accomplishing the goals of the organization (system). A system can be the entire organization, or any of its departments, groups, or processes.

Organizations (systems) have inputs, processes and outputs. Inputs include resources such as human resources, equipment, computers, raw materials, money, technologies and information. Inputs are processed to produce the outputs of the organization. Outputs are the results of the processes of the organization. Outputs can be goods or
services. Examples of goods are food, clothes, equipment and cars. Organizations produce services such as transportation services, education, and health care. Health care industry produces services such as providing health care, protecting against communicable diseases, and providing food services in hospitals. Feedback comes from multiple sources; from the managers, workers who perform processes, customers who use system services, newspapers and political leaders.

Organizations are composed of numerous subsystems, as well. Complexity of an organization is determined in part by the number of subsystems it has. Each subsystem has its own boundaries, inputs, processes and outputs with an overall goal for the subsystem. Common examples of subsystems are departments, units, projects, teams, or processes.

Organizations are defined by their mission, strategic plan, goals, policies and procedures, organizational charts, job descriptions and legal documents. Feedback within the organizational systems is maintained or controlled by its legal documents, policies and procedures, budgets and quality management programs. These managerial documents provide the standards and benchmarks for evaluating and improving organization's and individual's performance.

**Hospital as a System**

Systems theory concepts and principles can be applied to understand and explain hospitals and their operation. A hospital is defined as "any medical facility with an organized medical and professional staff and beds available for continuous hospitalization of patients formally admitted to it for medical observation, care, diagnosis, or surgical and non-surgical treatment" (Pan American Health Organization, 2004). Another definition is that a hospital is "an institution which provides beds, meals, and constant nursing care for its patients while they undergo medical therapy at the hands of professional physicians. In carrying out these services, the hospital is striving to restore its patients to health" (Miller 1997).

Hospitals are open systems that interact with the environment to complete necessary trades for survival of the system, growth, and fulfillment of systems' goal. A hospital is a subsystem that exists within a hierarchy of other systems. King Abdullah University Hospital is a subsystem of the Jordanian health care system. Additionally, Hospitals are complex systems, since they contain large number of subsystems such as the radiology department, nursing services, housekeeping, food services, laundry, laboratory department and so. Each of these subsystems can be looked at as a system of its own.

Hospitals are subsystems of overall health care system of a nation. For example, hospitals in Amman are considered to be subsystems of the health care system in Jordan which is defined as the aggregate of all health care authorities and
organizations that provide, finance, or monitor the provision of health care services to the inhabitants or visitors of Jordan and include hospitals, individual practitioners, health care centers, insurers, and other entities.

Information System: Another Example

An "information system" is defined as the organized combination of people, hardware, software, communication networks, and data resources that collects, stores, processes, transforms, displays, transmits disseminates and disposes information in accordance with defined procedures. An information system may be automated (e.g., a computerized information system) or manual (e.g., a library’s card catalog). Other examples of systems are health care system, hospital, and university.

References

