Asian Journal of Medicine and Health

5(1): 1-5, 2017; Article no.AJMAH.34421

The Hospital: A Complex Adaptive System

Díaz, Carlos Alberto[1], Castilla, Rodrigo Alberto[1*] and Lebersztein, Gabriel[2]

[1]Department of Medical Management, Sanatorio Sagrado Corazón, Buenos Aires, Argentina.
[2]Department of Medical Management, Obra Social de los Empleados de Comercio y Actividades Civiles, Buenos Aires, Argentina.

Authors' contributions

This work was carried out in collaboration between all authors. Author DCA designed the study and wrote the first draft of the manuscript. Authors CRA and LG managed the analyses of the study. Authors DCA and CRA managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJMAH/2017/34421
Editor(s):
(1) Abdelmonem A. Hegazy, Anatomy and Embryology Department, Faculty of Medicine, Zagazig University, Egypt.
Reviewers:
(1) Ibtissam Sabbah, Lebanese University, Lebanon.
(2) Abigail Mitchell, D'Youville College, USA.
Complete Peer review History: http://www.sciencedomain.org/review-history/19540

Opinion Article

Received 26th May 2017
Accepted 9th June 2017
Published 15th June 2017

ABSTRACT

Introduction: Numerous contemporary authors have described modern sanitary organisations as complex adaptive systems. Therefore, the behaviours and response patterns of their services and units are hardly intelligible if analysed by rationalist or Cartesian points of view.
Methodology: The information used in this study's process was extracted from Medline and LILACS databases, using the key words "Hospital", "Health Care Economics and Organizations", "Complexity Analysis", and "Healthcare Systems". No selection or exclusion criteria were used, due to the fact that the opinion developed in this article is based in the authors' personal experience and not in a structured revision methodology.
Results and Discussion: Hospitals are complex medical services companies due to many factors which alter their behaviour and work environment. They are governed by paradigms of complexity, and their structure, which needs to be particularly designed for the institution's purpose, is also complex. Medical care is provided within an interdisciplinary matrix, in which agency relationships are not always translated into coherent diagnosis and therapy plans. Furthermore, these relationships usually increase, or do not modify, the gap between effectiveness and efficiency.

**Corresponding author: E-mail: rodrigo.castilla@sagrado-corazon.com.ar;*

Hospitals are open systems, and work dynamically, out of equilibrium. Therefore, contradictory or unpredictable agent's behaviours are often seen affecting not only the organisation as a whole, but also the environment with which it interacts. Hospitals' limits are diffuse and flexible, and their results are greater than the sum of its parts.

Conclusion: The mentioned factors, among others, allow us to define a hospital as a complex adaptive system, which demands a new analytical approach, and the abolition of reductionist thinking. In this context, hospitals' leaders will have to know the institution's values, and simultaneously be used to working with tense flow logistics.

Keywords: Organisation and administration; health management; institutional development; organisational culture; leadership; management.

1. INTRODUCTION

Numerous contemporary authors have described modern sanitary organisations as complex adaptive systems. Therefore, the behaviours and response patterns of their services and units are hardly intelligible if analysed by rationalist or Cartesian points of view. Its extraordinary management architecture frequently determines an unpredictable evolution and development; furthermore, the strategic apex's reaction can even seem contradictory or paradoxical. However, a reanalysis is being promoted by integrated system interpretation, and the application of chaos theories and complexity paradigms. These new perspectives pretend to find new action lines in a real-life scenario in which the equilibrium is dynamic, interactions are predominant, and evolution never-ending.

2. METHODOLOGY

This article's discussion is the result of the authors' analysis of the bibliography, and the compilation of relevant data from the selected sources. The information used in this process was extracted from Medline and LILACS databases, using the key words "Hospital", "Health Care Economics and Organizations", "Complexity Analysis", and "Healthcare Systems". In addition, a book published by the main author (Díaz, Carlos Alberto) in its country of origin (Argentina) was included in the revision, even though it cannot be found in the mentioned databases.

No selection or exclusion criteria were used, due to the fact that the opinion developed in this article is based in the authors' personal experience and not in a structured revision methodology. However, only the articles which data is explicitly mentioned in the discussion were included in this article's references, in order to avoid exceeding the suggested limits (usually 15 references).

3. RESULTS AND DISCUSSION

Hospitals, enterprises specialised in health services' provision, are complex [1] due to many factors which affect their environment and function. Firstly, they are ruled by the paradigms of complexity [2]: non-linear behaviours of their professionals, patients and even their diseases. These paradigms are called dialogic, hologramatic and recursivity [3], and imply, respectively:

- That the patients' demand usually differs from his need, causing uncertainty.
- That the entire hospital is seen in each and every one of its members.
- That the patients, when discharged, become "health producing loops" with impact not only on their own health but on their family's and the whole community's health [4].

A hospital's structure is also complex, and needs to be specifically designed for its purpose and requirements. This is known as *adhocracy*. These organisations have six different components: the strategic apex, the middle line, the operating core, the technostructure, the support staff, and the culture or ideology in which the previous are included. The middle line transforms the strategic apex's orders into workflows. The operating core has a high education level. Therefore, they are constantly seeking to achieve their personal goals and develop themselves as consummated professionals. Empowerment is essential to achieve the institutional and strategic objectives needed to provide a high quality servuction model.

Different collectives work simultaneously in a hospital: physicians, nurses, administrative technicians, the patients and their families, and the owners or their representatives. In this context, contradictions between them are unavoidable [5]. Furthermore, patients' complexity at present is aggravated by multimorbidity and chronic diseases. Finally, four enterprises function in a hospital at the same time: a clinic, a hotel, an industry, and a high level education institution.

Healthcare services are produced within an internal matrix: a space with maximum interaction and interdiscipline, in which the agents buy meritorious goods in the name of the patient, the principals of the agency relationship. This relationship should be translated into a coherent diagnosis and therapy plan, which decreases the gap between effectiveness, efficacy, efficiency and cost minimization [6]. There are other agents, which work as inside providers, and are responsible for information, logistics and infrastructure maintenance.

As a result of all the mentioned facts, we can state that hospitals are complex adaptive systems [7,8]. The clinical practises, information organisation and management, research, education and professional development are interdependent, and coexist in an environment in which multiple systems continually interact. These characteristics are summarised in Fig. 1.

Adaptive systems work in a dynamic equilibrium, finding balance beyond stability or constancy. Although they are open, they are divided into inner aggregation levels, like a fractal, which embed their most competitive advantages: matrixes, hierarchic networks, continuous assistance, information systems, risk alerts, etc. Hospitals are in permanent interchange with the environment, the community, and its affiliates: frequent is the concurrence of patients, families, providers, workers, financers. The reductionist paradigm should be abolished and replaced with an innovative, emergent and intuitive vision of the world, in order to include an integral and integrated medical assistance within a healthcare model of continuity of care, in which services' organisation is based on performance. Therefore, the science which studies complex adaptive systems brings together the concepts and the tools which will be compulsory to face the 21st century's challenges [9].

Some uncertainties and paradoxes are always present in any complex system. As a result, many things will remain undetectable or even concealed [10]. Hospital's social actors, whose behaviours are frequently unpredictable, have liberty of action. Nonetheless, the effects caused by their decisions have a significant impact not only in their own collective but also in the organisation as a whole. For this reason, slight modifications can generate dramatic changes.

A hospital's main exchange is the assistance, through care and information, of people whose needs or symptoms demand translation into a diagnosis and therapy plan. Subsequently, a programmed bond is formed between the hospital and its population, justifying its social role, and keeping the system legitimately alive within a predefined programmatic area. The hospital is an intensive workforce organisation, and it is defined and conditioned by its own culture. In such a competitive, unstable and hostile market, not working in order to achieve excellence, efficiency, quality of processes and patient safety is utterly unacceptable. They ought not to work as closed systems, which respond only according to their own offer, but as open systems, which have the ability of information selection and process, consequently evolving to more complex systems, and obtaining integral health results, such as modification in life habits or in the relationship between people and their social environment [11,12].

Limits in adaptive systems are flexible and diffuse: their extension may change, and the organisation's agents can be members in more than one subsystem. On the contrary, mechanical systems' limits are clear, and fixed. Health organisations should take into account that subtle modifications in an external area or domain might produce unforeseen corporative reactions. Agents respond to environmental modifications by following a set of shared rules, generally induced by the medical industry or scientific societies, which can modify the collectives' behavior. Nevertheless, this set of shared rules is not always explicit. Furthermore, it is even considered ordinary that different collectives should perceive them in contradictory ways [13].

Observable results, when the value chain is strengthened, are greater than just the sum of their parts. They are the outcome of productive interactions between regular staff physicians, consultant specialists, nurses, kinesiologists, and

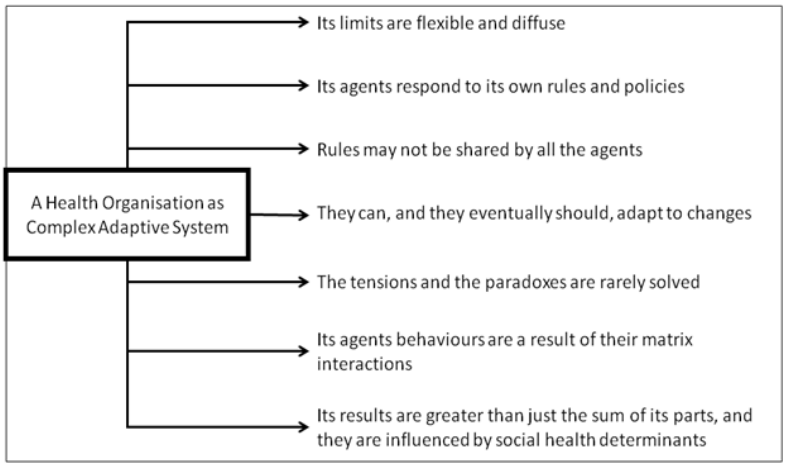

Fig. 1. Health organisations: Complex adaptive systems

many more. The reductionist paradigm's main defect is the incapacity to recognise this random combination of emergent phenomena [14].

In this analysis, health is conceived from a new topography, an innovative, dynamic vision, opposite to causality and linearity, which does not tend to reach equilibrium and is almost impossible to predict. For these reasons, health seen as a complex adaptive system is composed by five areas:

- the biological area,
- the technical/scientific area,
- the social area,
- the emergent global structure, and
- Life itself.

Leadership in complex adaptive systems requires managers who know and are involved with the organisation's mission and strategic objectives. In addition, they should be open minded, responsible, effective with projects and objectives, able to offer alternative solutions to a problem, good listeners, and team workers, coparticipating in successes and containing the individuals during crises. Managers should set an example, and demand their workers only those behaviours which they also demonstrate; they can identify the pressures and paradoxes of the strategic apex, middle lines, operating core, support staff and technostructure. Their virtues should be: dedication, concentration, recognition of high value workers, adaptability to change.

The role managers play in complex adaptive systems is far from being simple. They have the certainty, due to the system's "flux tendu" logistics, that there will be tension and that paradoxes are inherent to health organisations, and are not necessary solved. The tension is caused by the interaction between different complex systems. However, in these social systems, opposite market forces and competitive agents usually cooperate, enhancing collective performance, and therefore determining positive results [15].

The limitations of this opinion article are related with the relative narrowness of the authors' perspective, whose experiences have determined the type of research conducted and the criteria of the data's significance. Furthermore, the lack of a review protocol may have left critical information out of the analysis.

4. CONCLUSIONS

Hospital workers, executives and leaders should acquire the competencies needed to develop inside the paradigms of complexity, which includes chaos management, changing necessities, and the near future economic sustainability risk. They will require dexterous administration in order to stabilise the organisation in times of uncertainty and disequilibrium. Self-organisation, teamwork, production in matrix schemes, hierarchy based on values other than education or knowledge, will be virtues sought for not only in workers but also in healthcare systems. Furthermore, patients' complexity is steadily rising: increased rates of multimorbidity and pluripathology are observed

everywhere around the world. The factors analysed in this study have led us to the gates of an unknown and complex universe: the health organisation.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Bohórquez Arévalo LE. La organización empresarial como sistema adaptativo complejo. Estudios Gerenciales. 2013; 29:258-265.
2. Tarride MI. Hacia la constitución de una salud pública compleja. Rev Chil Salud Pública. 2005;9.3:160-174.
3. Díaz CA. La Empresa Sanitaria Moderna 2. Ediciones ISALUD. Buenos Aires.
4. Barasa EW, Molyneux S, English M, Cleary S. Hospital as complex adaptive systems: A case study for factors influencing priority setting practices at the hospital level in Kenya. Social Science & Medicine. 2017;174:104-112.
5. Fajardo-Ortiz G. Fernández Ortega MA. Ortiz Montalvo A. Olivares Santos RA. La dimensión del paradigma de la complejidad en los sistemas de salud. Cirugía y Cirujanos. 2015;83:81-86.
6. Blumenthal D, Chernof B, Fulmer T, Lumkin J, Selberg J. Caring for high-need, high cost patients an urgent priority. New Eng J Med. 2016;909-911.
7. Sturmberg JP, O'Halloran DM, Martin CM. Understanding health system reform—a complex adaptive systems perspective. J Eval Clin Pract. 2012;18(1):202–208.
8. Lipsitz LA. Understanding health care as a complex system: The foundation for unintended consequences. JAMA. 2012; 308(3):243-244.
9. Kannampallil TG. Schauer GF. Cohen T. Patel VL. Considering complexity in health care system. Journal of Biomedical Informatics. 2011;44:943-947.
10. Tsasis P, Evans JM, Owen S. Reframing the challenges to integrated care: A complex-adaptive systems perspective. International Journal of Integrated Care. 2012;12:1-11.
11. Toro-Palacio LF, Ochoa-Jaramillo FL. Salud: un sistema complejo adaptativo. Rev Panam Salud Publica. 2012; 31(2):161–5.
12. Ratnapalan S. Uleryk E. Organizational learning in health care organizations systems. 2014;24-33.
DOI: 10.3390/systems2010024
13. McDaniel Jr. RR, Lanham HJ, Anderson RA. Implications of complex adaptive systems theory for the design of research on health care organizations. Health Care Manage Rev. 2009;34:191-199.
14. Notarnicola I, Petrucci C, Barbosa MR, Giorgi F, Stievano A, Rocco G, Lancia L. Complex adaptive systems and their relevance for nursing: An evolutionary concept analysis. International Journal of Nursing Practice; 2017.
15. Ellis BS. The value of systems and complexity thinking to enable change in adaptive healthcare Organisations. Supported by Informatics 02 March Springer. 2016;Chapter 2:217-229.

Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/19540