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Healthcare teams as complex adaptive systems: Focus on interpersonal interaction

Peter Pype[a,*], Demi Krystallidou[b], Myriam Deveugele[c], Fien Mertens[c], Sara Rubinelli[d], Ignaas Devisch[e]

[a] Department of Family Medicine and Primary Health Care, University Hospital – 6K3, Ghent University, De Pintelaan 185, B-9000 Gent, End-of-Life Care Research Group, VUB & Ghent University, Belgium
[b] Faculty of Arts (Sint Andries Campus), Sint Andriesstraat 2, B-2000 Antwerp, Belgium
[c] Department of Family Medicine and Primary Health Care, University Hospital – 6K3, Ghent University, De Pintelaan 185, B-9000 Gent, Belgium
[d] Department of Health Sciences and Health Policy, University of Lucerne, Lucerne|and Swiss Paraplegic Research, Nottwil, Guido Zäch Strasse 4, 6207 Nottwil, Switzerland
[e] Department of Family Medicine and Primary Health Care, University Hospital – 6K3, Ghent University-Artevelde University College, De Pintelaan 185, B-9000 Gent, Belgium

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ABSTRACT

Objective: The aim of this study is to test the feasibility of a tool to objectify the functioning of healthcare teams operating in the complexity zone, and to evaluate its usefulness in identifying areas for team quality improvement.
Methods: We distributed The Complex Adaptive Leadership (CAL™) Organisational Capability Questionnaire (OCQ) to all members of one palliative care team (n = 15) and to palliative care physicians in Flanders, Belgium (n = 15). Group discussions were held on feasibility aspects and on the low scoring topics. Data was analysed calculating descriptive statistics (sum score, mean and standard deviation). The one sample T-Test was used to detect differences within each group.
Results: Both groups of participants reached mean scores ranging from good to excellent. The one sample T test showed statistically significant differences between participants' sum scores within each group ($p < 0{,}001$). Group discussion led to suggestions for quality improvement e.g. enhanced feedback strategies between team members.
Conclusion: The questionnaire used in our study shows to be a feasible and useful instrument for the evaluation of the palliative care teams' day-to-day operations and to identify areas for quality improvement.
Practical implications: The CAL™OCQ is a promising instrument to evaluate any healthcare team functioning. A group discussion on the questionnaire scores can serve as a starting point to identify targets for quality improvement initiatives.

1. Introduction

1.1. Complexity science in healthcare

A series of four papers in the BMJ in 2001 introduced the principles of complexity science in medicine and in healthcare [1–4]. Authors conclude that 'Clinical practice, organisation, information management, research, education, and professional development are interdependent and built around multiple self-adjusting and interacting systems' [3]. The unpredictability and paradox that are present in each of the aforementioned topics, due to their self-adjusting and interacting properties, call for new conceptual frameworks with a dynamic and creative view of the world. These frameworks should replace the views of the traditional explanatory model in medicine based on scientific positivism that describes the cause-effect relationship between two isolated events, which is just one factor underlying the dynamics of the mentioned topics [5]. In this respect, complex situations, requiring adaptive and probing behaviour, are to be distinguished from complicated situations, requiring analytical

* Corresponding author.
E-mail addresses: peter.pype@ugent.be (P. Pype), demi.krystallidou@kuleuven.be (D. Krystallidou), myriam.deveugele@ugent.be (M. Deveugele), fientje.mertens@ugent.be (F. Mertens), sara.rubinelli@paraplegie.ch (S. Rubinelli), Ignaas.Devisch@ugent.be (I. Devisch).

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cause/effect study and well-thought-through solutions. Complexity science belongs to the latest generation of systems thinking and studies complex systems [6], often called complex adaptive systems (CAS) by focusing on the relations and interconnections of the system components, rather than on the individual components themselves.

In the last few decades, complexity science has been cumulatively used as a theoretical framework in designing healthcare research to explore and understand complex healthcare-related issues [7]. A recent review on the use of complexity theory in health services research describes how authors identified relationships, self-organization, and diversity as the most frequently used attributes of complexity theory in health services research [7]. Consequently, every aspect and every level of healthcare has been framed and explored as complex adaptive systems: diseases, patients, practices, epidemiology, education, and organizations [1,5,8–15].

Equally, healthcare teams have been described as CAS [9,16–18]. The better understanding we acquire in this way, the better we may be able to optimize healthcare delivery. Research into the dynamics of healthcare teams using complexity science principles has, so far, mainly been explorative and descriptive [7]. Using a tool to objectify and quantify team functioning and interprofessional relationships could be of added value in understanding and optimizing team functioning. Table 1 shows the core principles of CAS, each illustrated by an example of healthcare team functioning.

1.2. Interprofessional healthcare teams

Interprofessional healthcare teams might operate in complex situations with high patient care needs and rapidly changing societal contexts. In order to deliver high quality patient care, healthcare teams need to adapt efficiently to the changing environment.

The adaptability of a team is subject to the communication and interactions between team members, as the team members' behaviour is based on their past interactions, and current and past interactions together pave the way for future behaviour [19–21]. Those interactions, resulting in team behaviour that addresses care needs in complex and uncertain circumstances, can be described with the use of the certainty-agreement diagram (see Fig. 1) [22].

Table 1
Core principles of CAS illustrated by examples of healthcare team functioning.

CAS principles	Examples of healthcare teams functioning according to the CAS principles
Complex systems consist of multiple components. Such systems are understood by observing the rich interaction of these components, not simply through the understanding of the system's structure.	In primary palliative care, specialised palliative care nurses are collaborating with general practitioners (GPs), community nurses, palliative care physicians, hospital-based specialists, as well as patients and their families. Understanding the structure and composition of this multi-setting collaboration is not enough to understand how patient care is actually being delivered. Therefore, we need to take the interprofessional relationships into account, based on mutual understanding and respect for each other's expertise.
The interaction between components can produce unpredictable behaviour.	A nurse reporting to a general practitioner the status of a patient who is still in pain after raising the pain medication three times may cause different reactions from different GPs. One GP may send the patient to the hospital for advice while another GP may arrange for a joint home visit with the nurse to re-evaluate the patient and jointly deliberate a change in therapy and keeping the patient at home. This all depends on the GP's self-confidence, his relationship with the patient, the patient's goals and preferences, the GP's current workload, the way the nurse reported on the pain etc. As such, the same action can produce different and unpredictable reactions.
Complex systems have a history and are sensitive to initial conditions.	A physiotherapist who makes therapy suggestions based on his expertise, to a physician about a patient and who is overruled by the physician will take this experience with him next time he works with this physician. He might present his next therapy suggestions in a different way compared to the first time or he might execute his therapy without notifying the physician. The way the next collaboration is being initiated, e.g. with clear agreements on tasks and responsibilities, might influence the interactional behaviour.
Complex systems interact with, and are influenced by, their environment.	A primary healthcare team is an open system, acting within the environment of the wider healthcare system with its rules and practice realities. Changing conditions, e.g. legal restrictions in nurses' tasks, availability of drugs and the installation of a new healthcare service in the area may alter the team's behaviour. This new behaviour can, in turn, influence the team's environment e.g. communication with the new healthcare service can lead to collaborative agreements.
The interactions between elements of the system are non-linear, that is to say that the results of any action depends on the state of the elements at the time, as well as the extent of the input. Minor inputs may have major effects, and vice versa.	A team member who forgets to log a change in the pain therapy (input) may receive a simple instruction from his colleagues to adjust his error (minor effect). On the other hand, if no one notices the error, the patient may receive the wrong dose and suffer major side effects followed by a major team dispute (major effect).
The interactions generate new properties, called 'emergent behaviours' of the system, which cannot be explained through studying the elements of the system, however much detail is known. In complex systems, such emergent behaviour cannot be entirely predicted.	A psychologist of a multidisciplinary team noticing burnout signs in one team member's behaviour may address the latter and urge him to respect his personal boundaries. This may cause a change in interaction with other team members, ultimately leading to a review of the team tasks and change in the way the team addresses patient care needs.
Complex systems are open systems: when observed, the observer becomes part of the system.	An external team coach, hired to optimise the team functioning and observing the team activities during a week may, by his mere presence, influence the team behaviour before he has started writing his report and presented his views to the team.

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