

Shared Medical Decision-Making: A Complexity Science Perspective

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ABSTRACT

Shared medical decision-making (SMD) represents an evolution from the traditional paternalistic model toward a more participatory approach, where the patient becomes an active agent in managing his/her own health, rather than a passive recipient. This transformation integrates not only scientific evidence but also the individuality of the patient: values, emotional, social, economic, and cultural context. Complexity, in turn, studies how patterns and unpredictable behaviors emerge from dynamic, non-linear interactions among multiple components of a system.

SDM is proposed as a complex intervention in the context of medical conditions. Deciding from this perspective recognizes that health problems are neither linear nor simple; they involve multiple variables, dynamic relationships, and uncertain outcomes. The choice, therefore, must emerge from an integrative process in which technical knowledge, clinical experience, expert judgment, intuition, and the patient's personal values interact. SMD is not reducible to the mere sum of isolated knowledge, but to the synergistic interaction between participants.

The complexity-based approach strengthens the SMD process by incorporating tools such as shared mental models, simulations, feedback, and multidisciplinary analysis. These tools enable the visualization of scenarios, anticipation of consequences, and adaptation of strategies according to the patient's evolving condition.

Ultimately, considering SMD as complex interventions means deciding a course of action jointly, through a dynamic, human, and deeply contextual process.

Keywords: shared medical decisions, complexity, patient-centered care, complex systems.

Decisiones médicas compartidas: una perspectiva desde la ciencia de la complejidad

RESUMEN

La toma de decisiones médicas compartidas (DMC) representa una evolución del modelo paternalista tradicional hacia un enfoque más participativo, donde el paciente deja de ser receptor pasivo y se convierte en agente activo de su salud. Esta transformación integra no solo la evidencia científica, sino también la individualidad de quien consulta: valores, contexto emocional, social, económico y cultural.

La Ciencia de la Complejidad, por su parte, estudia cómo surgen patrones y comportamientos impredecibles a partir de interacciones dinámicas y no lineales entre varios componentes de un sistema.

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Received: 03/4/2026 | Accepted: 07/21/2026 | Published: 09/10/2026

DOI: <http://doi.org/10.51987/Rev.Hosp.Ital.B.Aires.v46i3.1319>

How to cite: Rodríguez López A. Shared Medical Decision-Making: A Complexity Science Perspective. *Rev Hosp Ital B.Aires.* 2026;46(3):e0001319

Se propone que las DMC son intervenciones complejas en el contexto de problemas clínicos. Decidir desde esta perspectiva reconoce que las condiciones de salud no son lineales ni simples: involucran múltiples variables, relaciones dinámicas y resultados inciertos. Por lo tanto, la decisión debe surgir de un proceso integrador en el que interactúan conocimientos técnicos, experiencia clínica, juicio experto, intuición y valores personales del paciente. Las DMC no son reducibles a la suma de conocimientos aislados, sino que emergen de la interacción sinérgica entre los participantes.

El enfoque basado en la Complejidad fortalece el proceso de DMC mediante herramientas como modelos mentales compartidos, simulaciones, retroalimentación y análisis multidisciplinario. Estas estrategias permiten visualizar escenarios, anticipar consecuencias y adaptar conductas según la evolución del paciente.

En última instancia, considerar las DMC como intervenciones complejas implica tomar un curso de acción de manera conjunta, a través de un proceso dinámico, humano y profundamente contextual.

Palabras clave: decisiones médicas compartidas, complejidad, cuidados centrados en los pacientes, sistemas complejos.

INTRODUCTION

This article integrates the contemporary framework of shared medical decision-making (SDM) with insights from complexity science. We propose that SDM is not merely a communication or deliberative technique but also a complex clinical intervention, especially in contexts involving uncertainty, multiple values, and different reasonable courses of action.

Shared Medical Decision-Making: Complex Interventions

SDM is defined as a structured process of joint deliberation in which health care professionals and patients actively collaborate to make practical and applicable clinical decisions, integrating the best available scientific evidence on the existing options and their potential benefits and harms, the clinician's experience, and the values, preferences, circumstances, and life goals of patients.¹

Complexity science, in turn, examines how unpredictable patterns and behaviors emerge from dynamic, nonlinear interactions among multiple components of a system.² From this perspective, SDM can be understood as an adaptive process that goes beyond the application of evidence, in which clinical decisions emerge from the interaction among health care professionals, patients, and context under conditions of uncertainty, differing values, and outcomes that cannot be fully predicted.

SDM takes place within a complex framework involving multiple participants. It involves not only the patient and health care professional but also family members, caregivers, other members of the health care team, and the cultural and social norms surrounding the patient.³ This multiplicity of participants is accompanied by a diversity of values and goals, which may often diverge or even conflict, change over time, and be difficult to prioritize –characteristics that precisely define complexity.⁴

Medical consultations are complex systems; when understood as such, integrating SDM introduces new clinical, relational, and organizational dimensions (Table 1).

Decision-making in this context is influenced by structural uncertainty and incomplete evidence arising from data that may be ambiguous, inconclusive, or insufficient. This limits the ability to predict outcomes with certainty and requires participants to navigate probabilities and uncertain scenarios.⁵

The relationship between decisions and outcomes is “nonlinear,” as small variations in how information is communicated, the timing of a decision, or the emotional context can disproportionately affect patient adherence, satisfaction, and clinical outcomes.⁶ In complexity science, this phenomenon is known as the “butterfly effect.”⁷ SDM does not exist before the interaction between clinician and patient; rather, it emerges from the clinical encounter through dialogue and joint deliberation and cannot be understood simply as the sum of individual preferences.³ It is a dynamic process: decisions are revisited, preferences change, and the context evolves, requiring continuous adaptation to emerging circumstances.⁸

Finally, factors such as power asymmetries and contextual influences, including social inequalities, differences in knowledge, and institutional characteristics, significantly affect the decision-making process, shaping outcomes in ways that often lie beyond the participants' direct control.

Historical Context

Traditionally, medical consultations have taken place within an unequal relationship, characterized by a predominantly paternalistic physician-patient model in which patients have played a largely passive role.⁹

Over time, there has been a gradual shift from passivity to active participation, with growing recognition of each patient's uniqueness. Approaches such as

Table 1. Medical consultations are complex systems^{2,5,6,10}

Characteristics of complex systems	Medical consultations	Complexity
Interconnectedness System components are interrelated	Interaction among physician, patient, family, clinical situation, social environment, and health care system	A change in one factor (e.g., diagnosis) affects decisions, emotions, and treatments
Emergence New properties emerge that were not present in the individual components	The physician-patient relationship generates trust, adherence, or resistance to treatment	The quality of the outcome depends not only on medical knowledge but also on the interaction
Nonlinearity Small causes can produce large effects	A physician's comment can completely change the patient's attitude toward treatment	There is no direct proportionality between action and outcome
Feedback Each outcome feeds back into the system	Changes in symptoms influence therapeutic decisions; response to treatment leads to adjustments in the plan	The process is dynamic and is continuously readjusted
Adaptability The system continuously adjusts to changes in its environment	The physician adapts treatment according to age, culture, resources, and clinical response	No single rigid protocol applies to all cases
Self-organization Order emerges; the system self-regulates	The health care team coordinates its actions according to the patient's needs	Organization emerges through interaction
Dynamic nature The system changes over time	The patient's condition evolves; the diagnosis may change	The consultation is not a static event but an ongoing process

empathic communication, motivational interviewing, and therapeutic patient education have improved on the paternalistic model, but they remain insufficient for fostering patient participation. They have improved the quality of the patient-clinician relationship, facilitated behavioral change, and enhanced knowledge transfer, but they are not processes specifically aimed at collaborative decision-making.

From a complexity perspective, the fundamental differences between these approaches and SDM are evident at multiple levels. The patient, for example, plays an active role and co-creates decisions.⁸ The approach shifts from linear and unidimensional to systemic and multidimensional. Uncertainty is managed differently: rigid protocols give way to flexibility, dynamic adjustment based on outcomes, and the inclusion of family dynamics. Communication shifts from unidirectional to multidirectional and may include facilitators when necessary.⁹ Problem identification, previously focused on symptoms and diagnoses, now encompasses social

and psychological factors as well as interconnected dynamics.¹⁰

Thus, SDM constitutes a complex intervention that emerges through deliberative processes and takes into account patients' personal circumstances and their psychological, emotional, cultural, social, and economic context. This understanding, together with the ethical principles of self-determination, recognizes the patient's right to participate actively in health care decisions.¹

Patients, in turn, must take an active role by expressing their willingness to participate and ensuring that their views are taken into account.¹¹

Decision-Making from a Complexity Perspective: Complicated versus Complex

Health problems are inherently complex and occur within equally complex environments. Health care professionals and patients do not face isolated problems but rather diverse, interacting dynamic systems.¹² For example, failure to respond to treatment may result

from various factors, including adherence, medication substitution, biological resistance, or patient mistrust, among many others. In this context, decision-making entails the ability to take effective action in situations that require change, improvement, or transformation.

Far from being merely a matter of semantics, the distinction between complicated and complex is crucial to understanding SDM as a complex intervention.¹³ Linear, predictable systems with clear cause-and-effect relationships characterize complicated problems. They can be solved through a series of steps, formulas, or algorithms, with a “correct” solution that produces reproducible results entirely determined by the initial conditions, leaving no room for chance. Interactions among the components are limited or simple, and predictability is high: if the appropriate steps are followed, the expected result is obtained.

In contrast, complex problems occur within dynamic, nonlinear systems characterized by emergent and interdependent interactions.¹³ There is no single solution; they require collaboration, continuous learning, and the participation of multiple stakeholders, while taking into account the system’s sensitivity to small changes. Outcomes are emergent and unique to each context and point in time, and predictability is therefore low. Strategies for addressing these problems must be integrated and continuous and may involve simultaneous or sequential courses of action, experimentation, adaptation, iteration, and joint deliberation.²

What Does a Complexity Perspective Contribute to SDM and to the Overall Decision-Making Process?

SDM is unsuitable for all clinical situations. The most appropriate scenarios for introducing SDM are those in which several reasonable options are available –whether therapeutic, diagnostic, or management-related– with no option clearly superior to the others.¹⁴ SDM is also appropriate when research does not provide a single or conclusive answer; that is, when the evidence is insufficient or ambiguous. Other relevant scenarios include decisions that significantly affect physical, emotional, or social aspects of a patient’s life, as may occur with cancer treatments associated with substantial adverse effects; decisions involving considerable risks or costs; situations in which the patient’s values, beliefs, or context are crucial to the choice; and ethically sensitive situations.¹⁴

When SDM is applicable, the literature shows that both physicians and patients benefit.¹⁵ Patients gain greater autonomy and control through active participation, develop a better understanding of their options, and can express their values and preferences. Joint deliberation allows patients to understand risks, benefits, and alternatives and leads to more personalized decisions. When patients feel heard and understood, they become more engaged with the treatment plan. Dialogue and clear information lessen the sense of loss of control, thereby reducing anxiety and uncertainty.¹⁶

Physicians, in turn, become more closely aligned with patients’ values and with what matters most to them. Active patient participation reduces treatment nonadherence or refusal. The clinical relationship improves, with greater trust, mutual respect, and better communication. Health care team members experience greater professional satisfaction and further develop their skills in communication, uncertainty management, and systems thinking.¹⁷

A complexity perspective recognizes that physicians, patients, and their environment form a dynamic system that adapts and evolves. Incorporating this perspective entails important changes in health education, professional training, and health care systems. Health care professionals will need to develop further competencies for managing complexity, advanced communication skills, uncertainty management, and relational ethics,¹⁸ while recognizing that complex decisions cannot be broken down into linear steps because complete or sufficient information to select the “optimal” option is not available. Outcomes are therefore neither predictable nor stable; protocols are useful only to a certain extent; evidence, intuition, and context must be integrated; and clinical judgment assumes greater importance. The physician-patient interaction becomes central and an integral part of the dynamics of decision-making.¹⁹

Health care systems, in turn, will need to design more flexible processes and guidelines that allow for adaptation. Coordinated work within interprofessional teams will become essential, and health policies and planning will need to incorporate the concept of complexity. Metrics will assess not only adherence to standards but also satisfaction, decision quality, and learning.²⁰

Tools for Managing Complexity in SDM

In clinical practice, addressing the wide range of variables involved in SDM requires specific tools that facilitate communication, mutual understanding, and anticipation of consequences.²¹ Table 2 summarizes the main tools used to address complex clinical situations effectively.

These tools not only enable more effective dialogue between the health care team and the patient but also promote a deeper understanding of the dimensions involved in SDM.

Developing shared mental models allows both parties to jointly visualize the specific situation and possible alternatives. An example is a patient who takes antihypertensive medication irregularly because they do not feel ill. Exploring the patient’s mental model involves asking key questions such as: “What do you think high blood pressure is?”, “What concerns you about the treatment?”, and “What do you hope to achieve?” These responses help the health care team understand the patient’s perception of their condition. In this example, responses such as “Blood pressure is just a number,” “If I feel well, I don’t see why I need to take pills,” or “I don’t want to depend on medication” allow the health care professional to integrate relevant medical information

Table 2. Tools for influencing complex situations in SDM

Tool	Description	Ejemplo de aplicación
Shared mental models ³¹	Joint development of cognitive representations of the problem to improve mutual understanding	Physicians and patients discuss expectations and goals
Process and systems maps ³²	Visualization of relationships and dynamics among factors to identify potential points of intervention	Diagrams showing interactions between symptoms and treatments
Facilitation and mediation ¹	Use of facilitators to guide communication and resolve conflicts during the clinical encounter	Psychologists help clarify priorities
Simulation and scenarios ³³	Exercises that help anticipate the consequences of different decisions	Role-playing treatment decisions
Continuous feedback ²⁹	Periodic adjustments based on ongoing assessment of outcomes and experiences	Regular reviews of the treatment plan
Open and empathic communication ¹	Creation of an atmosphere of trust that allows information and emotions to be shared openly	Clinical interviews in which patients' concerns are acknowledged and addressed
Training and education ³⁴	Training to improve skills in shared decision-making and complexity management	Workshops for physicians and patients on communication
Multidisciplinary analysis ³⁵	Integration of diverse perspectives to address the problem from different disciplinary viewpoints	Health care teams comprising physicians, psychologists, and social workers

into the deliberation. In this case, the professional can explain that hypertension is a silent condition that increases the risk of stroke and myocardial infarction and that the goal of treatment is to prevent future harm.

By the end of this process, the patient may understand that they want to avoid complications while minimizing the number of medications they take.

The patient and health care team can then jointly develop a plan involving lifestyle changes and gradual medication adjustments that everyone involved can accept. This exercise helps participants develop a shared understanding of the problem, set common goals, align expectations, make decisions together, and build

commitment to treatment. Continuous feedback allows decisions to be adjusted as the disease progresses and new evidence emerges.

Process and systems maps, in turn, provide a broader perspective. For example, someone trying to lose weight can visualize the interrelated factors that affect dietary adherence, such as work-related stress, emotional fluctuations, frustration, depression, insomnia, and physical activity. Each point on the map identifies a potential intervention aimed at achieving the desired outcomes, and modifying one factor will affect the others.

Facilitation and mediation can also be crucial in resolving conflicts involving values or preferences. They

generally involve a third party who helps health care professionals and patients clarify key aspects of diagnostic dilemmas and, in particular, therapeutic uncertainties.

Taken together, these strategies enrich the decision-making process, enabling more humane, context-sensitive, and effective clinical practice.²²

Thus, to design strategies that foster SDM from a complexity perspective, both health care professionals and patients must explore the rules and patterns that shape their interactions and draw on theories, principles, and guidelines that allow them to build knowledge adaptable to each situation. An external problem must be observed, reflected upon, and interpreted within a frame of reference that shapes what is perceived, interpreted, and understood.

Different conceptual frameworks, each with its own language and particular ways of characterizing a situation, facilitate interpretation of the system from multiple perspectives (multidisciplinary and transdisciplinary), thereby providing a deeper understanding.¹ In SDM, the predominant framework derives from the medical sciences, but ethical, social, humanistic, educational, and communication frameworks also play a role. Each clinical encounter is unique and may require a different framework—or a combination of several frameworks—and may produce different emergent outcomes.²³

Although each tool has its own causal impact, the system's complexity makes it impossible to predict outcomes precisely. Regarding emergent phenomena, although not all causes can be identified, one or more of these tools can help move toward the desired outcomes.²⁴

Integration of SDM and Complexity

Although SDM and the complexity perspective provide a valuable theoretical framework, they should not be idealized as linear or perfect processes. Their true value lies in their practical contribution: guiding physician-patient interactions in a more adaptive way that centers on the patient's values and responds to clinical uncertainty, promoting more contextualized, flexible, and sustainable decisions in everyday practice.²⁵

A practical example would be that of a 78-year-old woman with chronic comorbidities who has been diagnosed with advanced, slow-growing breast cancer. The patient has already received hormone therapy combined with CDK4/6 inhibitors, but the disease has continued to progress.

The medical literature indicates that chemotherapy in such cases may modestly prolong survival. However, it may also cause significant adverse effects, including severe fatigue, risk of infection, potential functional decline, hospitalization, myelosuppression, and heart failure.²⁶ If disease progression is slow and there is no critical visceral involvement, the therapeutic decision is not straightforward. Clinicians must weigh quality of life, risks, and the patient's preferences.

The patient may prefer to preserve her quality of life and autonomy and spend meaningful time with her family, creating a clear dilemma between the potential benefits of treatment and her personal values. This conflict may

intensify if her children pressure her to pursue aggressive treatment. The patient may then feel that her autonomy is being constrained and may feel overwhelmed by the authority she attributes to physicians and family members. The medical team, in turn, faces scientific evidence that, on the one hand, reports benefits of chemotherapy in older patients²⁷ and, on the other, warns of functional decline and treatment-related toxicity.²⁸

A clear and understandable explanation of the therapeutic options, their risks and benefits, and their potential impact on quality of life, together with careful consideration of the patient's values and preferences, will enable those involved to reach a shared decision and negotiate family expectations by identifying which adverse effects the patient considers acceptable and which aspects of autonomy matter most to her. This process may lead to a plan that primarily respects her wishes and preferences while keeping the therapeutic approach flexible, with the possibility of modifying the strategy as outcomes emerge.

CONCLUSIONS

In summary, approaching SDM from a complexity perspective seeks to develop the ability to understand the behavior and deeper meaning of interactions. While traditional decision-making processes can address simple and complicated elements, complex components require adaptive, iterative, and collaborative strategies. Many rational decision-making processes may fail if they do not account for the problem's multidimensional nature.⁸

To date, medicine has received only superficial consideration of complexity.² The term has been used primarily in a descriptive sense rather than as a conceptual tool capable of guiding the design, implementation, and evaluation of health care interventions. Consequently, many of these interventions continue to rely on linear models that fail to fully capture the inherently complex nature of the problems and situations encountered in health care practice.²⁹

We propose recognizing SDM as a complex intervention,³⁰ despite the challenges this entails for implementation, standardization, measurement, and reproducibility. Further studies are needed to assess the generalizability of this approach across different clinical settings and population models, thereby strengthening the practical application of complexity science to shared medical decision-making.

Conflicts of Interest: The author declares no conflicts of interest related to the content of this work.

Funding: The author declares that this study received no external funding.

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