


The relevance of the contribution of psychoneuroendocrinoimmunology and psychology of reasoning and decision making to nursing science: A discursive paper

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Abstract

Aim: Patients' death or adverse events appear to be associated with poor healthcare decision-making. This might be due to an inability to have an adequate representation of the problem or of the connections among problem-related elements. Changing how a problem is formulated can reduce biases in clinical reasoning. The purpose of this article is to explore the possible contributions of psychoneuroendocrinoimmunology (PNEI) and psychology of reasoning and decision-making (PRDM) to support a new nursing theoretical frame.

Design: Discursive paper.

Method: This article discusses the main assumptions about nursing and nurses' ability to face patient's problems, suggesting a new approach that integrates knowledge from PNEI and PRDM. While PNEI explains the complexity of systems, highlighting the importance of systems connections in affecting health, PRDM underlines the importance of the informative context in creating a mental representation of the problem. Furthermore, PRDM suggests the need to pay attention to information that is not immediately explicit and its connections.

Conclusion: Nursing recognizes the patient–nurse relationship as the axiom that governs care. The integration of PNEI and PRDM in nursing theoretics allows the expansion of the axiom by providing essential elements to read a new type of relationship: the relationship among information. PNEI explains the relationships between biological systems and the psyche and between the whole individual and the environment; PRDM provides tools for the nurse's analytical thinking system to correctly process information and its connections.

Impact on Nursing Practice: A theoretical renewal is mandatory to improve nursing reasoning and nursing priority identification. Integrating PNEI and PRDM into nursing theoretics will modify the way professionals approach patients, reducing cognitive biases and medical errors.

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KEYWORDS

clinical reasoning, decision making, nursing, nursing priority, nursing theoretics, psychology, psychoneuroimmunology, theoretical nursing

1 | INTRODUCTION

The purpose of healthcare organizations and providers is to provide safe and high-quality healthcare. According to the World Health Organization (WHO), millions of patients are injured or killed each year as a result of unsafe care. Most of the issues that lead to negative outcomes are preventable. In this scenario, nurses are fundamental in the identification and prevention of adverse events in patients, considering that they are both the primary caregivers and the largest population among health professionals. However, limited nursing resources, the high variability in patient needs, the type of work often characterized by high complexity and time pressure and the heavy workload are all obstacles to the prevention of adverse events (Zhao et al., 2020).

More specifically, in the current time, characterized by increasing organizational-clinical complexity, nurses are required to make ongoing clinical, managerial, ethical, practice and policy decisions. Therefore, their decision-making ability is essential to ensure patient safety and the standard of nursing care (Chen et al., 2016; Johansen & O'Brien, 2016). However, nurses' ability to logic and decision-making may be impaired due to limited resources and the increase in the number of available information from different fields (e.g. physical, social, etc.) and from various channels (digital, analogue, etc.) leading to possible cognitive biases (Chen et al., 2016; Mantovan et al., 2020; Martin et al., 2022). The significant contribution of cognitive biases to adverse events in healthcare has been widely demonstrated, inducing researchers to consider them a real major problem in clinical decision making (Thirsk et al., 2022).

Most of the research on the impact of these systematic errors in judgement has focused on diagnostic decision-making, primarily by physicians. As the largest component of the workforce, nurses make numerous decisions that affect patient outcomes, with one of the most important processes being prioritization (Jessee, 2019; Lake et al., 2009). In this line, necessary care is more likely to have been missed when registered nurse staffing levels are low (Ball et al., 2018). Independently of organizational issues, the professional's clinical reasoning and definition of nursing priorities can be fostered in order to limit the possible errors. When these errors are systematic and predictable, in fact, there is the opportunity to develop interventions to reduce biases, by means of a more accurate observation of the context, a more comprehensive data collection and an improved decision-making

process (Croskerry, 2015), thus improving healthcare and patient outcomes (Thirsk et al., 2022).

1.1 | Prioritization

Prioritization is a specific decision-making process that leads to the categorization of patient care problems and demands distinguishing those that require an immediate action and those that can be postponed because they are not considered urgent or relevant (Alfaro-LeFevre, 2001; Bowers et al., 2001; Hendry & Walker, 2004; Schubert et al., 2021).

Although prioritization is a complicated process per se even when dealing with patients with a single disease, it becomes even more complex and at risk of judgmental biases when patients present multiple chronic conditions (i.e. multimorbidity, a currently frequent condition) (Jessee, 2019). At present, no clinical practice guidelines have been defined to address multimorbidity conditions, nor to guide prioritization in these particular patients (Sturmberg et al., 2021). As a result, priorities may be defined by a limited number of data focused on the specific problem-related domain for which the patient is seeking for assistance. For example, current research and clinical practice in cardiovascular disease have fostered a disease-specific care paradigm: the focus is predominantly on the management of a single disease rather than on the complexities imposed by multimorbidity, with unpredicted consequences. As Forman et al. (2018) posited 'accumulating conditions may induce or exacerbate other diseases through common pathophysiology (e.g., chronic inflammatory pathways of CVD increasing the risks of developing diabetes or depression)'. Moreover, Forman illustrated 4 types of common sequelae of multimorbidity characterized by specific interaction: (1) disease-disease (e.g. heart failure, chronic kidney disease and hypertension); (2) disease-drug (e.g. heart failure and nonsteroidal anti-inflammatory drugs for arthritis); (3) drug-drug (e.g. omeprazole and warfarin) and (4) therapeutic competition when a medication for one disease inadvertently destabilizes another (e.g. beta-blocker for heart failure worsening bronchospastic lung disease).

In this line, while a linear thinking process can be more easily used in the presence of a single disease where a cause-effect relationship can be immediately seen, multimorbidity may require a systemic approach, as suggested by complexity science (Sturmberg et al., 2021). Complexity science considers multimorbidity not as

the sum of discrete diseases, but rather as 'an emergent state arising from the interactions between a multitude of factors in a person's socioecological environment and inherited biology (Sturmborg et al., 2021). According to this perspective, to identify the priority, a nurse should consider the relationships among all factors affecting the patient's health condition (including the patient's living context), the possible actions to be taken and the effects of such actions on the different morbid conditions simultaneously present in the multimorbid patient (Milani et al., 2023).

1.2 | The complexity of the human-beings' living context

If, according to Sturmborg (Sturmborg et al., 2021), the socioecological environment is one to the contributing factors of health and disease, one should also pay attention to the continuous changes of such an environment. During the past two decades, social, clinical and health contexts have certainly changed, returning a picture of an older and poorer society that is more characterized by chronic diseases and pervasive multimorbidity that are increasing in incidence and prevalence. The current context is also characterized by wars and violence, earthquakes, pollution, water scarcity and rising temperatures, which return an image of great fragility of the whole society (Cluley et al., 2023). Although social networks and social support have generally been a mitigating factor of individual and social frailty (Makizako et al., 2018), a recent study (Röhr et al., 2022) reported that one in ten adults indicated being socially isolated and that the prevalence is strongly influenced by sociodemographic and socioeconomic factors, with a higher frequency among men of older age. Social isolation is one of the main epidemiological risks for the development of cardiovascular disease, cancer, Alzheimer's disease and mortality in general (Cole, 2014, 2019). Furthermore, social isolation complicates the patient's protected discharge and the implementation of rehabilitation programs.

From a nursing perspective, such worrying context is even worsened by the increasing complexity of the workplace environment described in the introduction. On this point, the WHO reports a 7.2 million healthcare worker shortage despite the increase in health care demands. Similarly, the Third Global Forum on Human Resources for Health study predicted a shortage of 12.9 million nurses by 2035 (Marc et al., 2019), estimating an increase in workload, with the obvious consequence of essential nursing tasks left undone in the presence of heavy workloads (Marc et al., 2019). According to such studies, heavy workloads impair nurses' ability to perform a comprehensive baseline assessment of patients and their complexity, to monitor the patient over time, to detect any changes in deteriorating patients and to evaluate outcomes of nursing care. All of these compromised nursing abilities negatively impact patient outcomes. As Dresser suggested (Dresser et al., 2023), the nurses' ability to decide which tasks leaving behind may be further worsened by the loss of professional values or the loss of consistency of these values with the current working context.

1.3 | A need for multilevel data integration

Despite the emerging and recognized relevance of complexity science in healthcare in the last decades, still its implementation in clinical practice is still far from optimal (Braithwaite et al., 2021); yet, the simplest way to manage healthcare is to ignore or deny its complexities and to opt for a linear conceptualization of clinical decisions and activities, such as, for example, in considering the strict relationship between a test and a diagnosis (Braithwaite et al., 2021). Also, nurses report that they attend patients' medical (physiological) needs, and adopt a 'curative' approach in prioritizing of patient healthcare (Albsoul et al., 2021). Accordingly, the investigation of patients' complexity and the interaction among the multitude of factors affecting their health condition are far to be implemented in nursing clinical practice.

The current dominant paradigm is reductionist, whose premise is that a system can be best understood and solved by breaking it down into its constituent parts (a cardiovascular disease separate from other possible clinical conditions) and addressing each one separately (see the example of the disease-specific care paradigm used for cardiovascular disease). According to Braithwaite (Braithwaite et al., 2021), the complexity of the healthcare system necessitates a learning environment where practitioners are expected to anticipate and adapt to this ongoing change.

Accordingly, the level of attention has to be put on (1) the capacity to anticipate consequences of actions derived from multilevel decisions, and on (2) the interaction of multilayer data and systems that contribute to the emergent dynamic health state.

While for the first point education and training on psychology of reasoning and decision-making (PRDM) is crucial, the knowledge on the interaction among multilayer data and systems can be well explained by the Psychoneuroendocrinology (PNEI) approach, which studies the physiological interactions among the brain, the behaviour, the immune and endocrine systems and the social and physical environment (Bottaccioli & Bottaccioli, 2020; Zachariae, 2009). A comprehensive knowledge and a set of complete information are essential for a high-quality decision-making process (Kahneman et al., 1982; von Neumann & Morgenstern, 2007). However, knowledge on a topic is not always sufficient for a good result. Evidence in PRDM shows that the more complex the decision context is, the less analytical and precise the adopted decision-making process will be (Kahneman et al., 1982). Therefore, while PNEI can help with knowledge on what to look for, PRDM can offer tools and strategies on how to look at.

This article proposes evidence in support of the need of integration of the two aforementioned disciplines (PRDM and PNEI) in the ontological study of nursing, and of the utility (i.e. the expected gain) such specific knowledge and methodologies can bring in the field.

The need for such integration follows the importance that nursing scholars put on continuing research and academic discussion in the area of nursing theory development (Hopia & Heikkilä, 2020). Hopia and Heikkilä highlighted the absence of literature: the

gap between research and theory is growing, and constant re-examination of nursing theories is needed to clarify the domain of nursing and guide nursing practice (Hopia & Heikkilä, 2020). In particular, according to researchers, only a few indications about nursing theory are contained in current nursing research strategies and policy articles, while the elaboration and evaluation of nursing theories should receive more attention in order to propose a framework coherent with the recent scientific advances and supporting nurses in their clinical practice where contexts are more and more complex (Hopia & Heikkilä, 2020).

Coherently, this work wants to provide evidence on the importance of the integration of PNEI and PRDM in nursing theory. To this purpose, the present work illustrates for each discipline (PNEI and PRDM, respectively): (1) the historical-conceptual background; (2) the key concepts of PNEI [PRDM] for nursing; (3) the implication of PNEI [PRDM] for nursing practice.

2 | METHODS

To respond to the purpose of the present work, the method included three main phases.

First, the authors consulted relevant disciplinary texts and experts in the specific topics of interest (PNEI, PRDM and Nursing Theoretics).

The authors then searched the literature published from 2000 in Medline (PubMed and Ovid), PsycInfo, CINAHL and Google Scholar to assess the available scientific evidence on the integration of psychoneuroendocrinology with psychology of decision making, and nursing theoretics. The following query was used: (“psychoneuroendocrinology” OR “PNEI” “psychoneuroimmunology” OR “PNI”) AND (“psychology of decision making” OR “decision making psychology” OR “decision making” OR “reasoning”) AND “nursing”). The literature search resulted in only four articles. After reading the abstract and/or the full text, three articles were excluded due to the absence of one or two of the disciplines. Only 2 remaining articles propose the integration between the PNEI and nursing disciplines (Milani et al., 2023; Walling, 2006), with one of these also integrating the PRDM (Milani et al., 2023).

Finally, the hypothetical emerging framework was shared among different disciplinary experts and from different contexts (academia and practice) and summarized in the present work.

3 | PSYCHONEUROENDOCRINO IMMUNOLOGY AND NURSING SCIENCE

Psychoneuroendocrinology has made significant contributions to the understanding of the behavioural and biological processes that link psychosocial factors, health and disease. Some of the PNEI concepts influenced some nursing theorists (for example, Betty Neuman and Callista Roy) in the conceptualization of their models (Zachariae, 2009), however still they were missing health-contributing concepts that are now integrated in the PNEI approach thanks to the latest scientific evidence.

3.1 | Historical-conceptual background

3.1.1 | The birth of PNEI

For many decades, the immune system was considered ‘autonomous’, that is, not in relation to other systems and involved in interaction only with an antigen. However, research in this area was conducted on *in vitro* cell lines, thus preventing its systemic view. The first real study of psychoimmunology probably dates back to 1919, when an association between negative emotions and immune system activity was demonstrated in patients with tuberculosis, followed by studies on the connection between the brain and the immune system, indicating that the immune system could be affected by classical conditioning and the physiological stress response (Zachariae, 2009). Table 1 shows the main stages and related theories in the evolution of this discipline from its earliest steps up to the definition of psychoneuroimmunology in 1981, and to the first conference in 1986. The main themes addressed in the 1986 conference were: the existence of a relationship between the brain and the immune system; the possible bidirectionality of this relationship; the presence or absence of possible mediators of such relationship; and the usefulness of this relationship in understanding health and

Date	Discovery	Scientist
1919	Emotion and immunity in tuberculosis	Ishigami
1920	Interaction between brain and immune system	Pavlov's pupils
1930	Stress models definition	Hans Selye
1957	Psychological stress and susceptibility increasing to infection	Rasmussen, Marsh & Brill
1960	Psychological stress and autoimmune disease exacerbation	Fessel & Solomon
1981	Psychoneuroimmunology definition	Ader
1986	First conference on psychoneuroimmunology	Cohen

TABLE 1 Main steps of psychoneuroendocrineimmunology development process, schematized from Zachariae (2009).

disease (Cohen, 1987; Zachariae, 2009). Since the 1990s, scientific research has seen an explosion of research studies in the field of PNEI (Bottaccioli & Bottaccioli, 2020).

From PNEI studies, the human beings emerge as the product of the relationships among their internal systems and between these systems and the external environment.

3.1.2 | The influence of PNEI on nursing science

Reviewing the history of nursing theoretics, a PNEI's implicit influence on the theorists' thinking was found as early as the late 1900s. Since the 1970s, Callista Roy was deeply influenced by the PNEI-developing approach, proposing an adaptation-based conceptual model that reproduced the structure of the immune system with its innate and acquired components (Meleis, 2017). Roy's sub-regulatory system functioned through the autonomic nervous system (ANS) and consisted of neural, endocrine and psychomotor parts. Furthermore, observable responses of the body to stimuli coming from the internal and external environment were interpreted as the effects of the ANS responses, the endocrine gland reactivity and the process of cognitive perception (Meleis, 2017).

In the same years, Betty Neuman elaborated a systems model that bears her name (i.e. The Neuman systems model), by introducing the concept of stress, which represents the root of PNEI (Meleis, 2017). Influenced by the PNEI studies, Betty Neuman defined the person as an open and complex system, interacting with internal and external factors capable of determining individual stress (Meleis, 2017).

Finally, at the beginning of this new millennium, PNEI became an explicit and necessary resource in some models of nursing research. Noteworthy is the biobehavioral approach proposed by Kang (Kang et al., 2010). Although this cannot be called a true theory due to the absence of the classical theoretical framework, it provides a completely new approach to nursing research. In her article, 'Stress and Inflammation: A Biobehavioral Approach for Nursing Research, Kang introduced the concepts of inflammation and biomarkers (Kang et al., 2010). Her model incorporated three previously conceived models of stress: (1) the physiological model of stress (Selye, 1976), (2) the cognitive appraisal model of stress and coping theory (Lazarus & Folkman, 1984) and (3) the stress, allostasis and allostatic load model (McEwen, 1998a, 1998b, 2003). According to Kang, the combination of these three models made it possible to identify both the adaptive processes that an individual enacts and the distress cumulative effects (Kang et al., 2010).

3.2 | PNEI key concepts for nursing: Allostasis and allostatic overload

The most relevant and new concepts proposed by the PNEI approach that should be considered are allostasis and allostatic load. The term allostasis refers to the dynamic biological processes activated by an individual to cope with changes in the environment to maintain the

physiological systems stability through the recalibration of homeostatic parameters (McEwen, 1998a, 1998b, 2003; Sterling, 2012). In other words, while homeostasis is the mechanism that ensures the maintenance of an organism's internal parameters around relatively constant values, allostasis is the mechanism by which a new equilibrium condition is achieved through change. Allostatic responses are physiological alterations that occur when there are disruptions in the external or internal settings. These alterations serve to enhance the organism's ability to adapt to its changing surroundings. The immune system, cortisol, the ANS and metabolic hormones are some of the mediators needed for this adaptation (Mocayar Marón et al., 2019). These elements work together to promote adaptation, but when they are dysregulated (as they can be when there is prolonged stress), they can have harmful effects that have pathophysiological ramifications, such as systemic inflammation, telomere shortening and increased oxidative stress to hasten the aging process (Mocayar Marón et al., 2019). Consequently, in the presence of a threat or adversity, the organism responds throughout the activation of a stress response by means of the activation of the hypothalamic-pituitary-adrenal axis, and the specific activation of the neuroendocrine and immune systems. However, such mechanisms, necessary to solve the threat or to adapt to the adversities, imply a cost the body has to pay—named allostatic load—defined as the cumulative burden of chronic stress and adverse life events (Bottaccioli & Bottaccioli, 2020; Guidi et al., 2021; McEwen, 2000). Specifically, the allostatic load is caused by (1) exposure to frequent and cumulative stressors capable of producing a state of chronic stress and long-lasting physiological arousal; (2) the inability to turn off the stress response after the end of a stressor; (3) the lack of adaptation to repeated stressors and (4) inefficient functioning of the stress response system (Bottaccioli & Bottaccioli, 2020; McEwen, 2000, 2020).

Finally, the allostatic load also includes the physiological consequences of all these health-damaging behaviours, such as lack of sleep, lack of exercise, smoking, alcohol consumption and an unhealthy diet (Pagiatakis et al., 2021). Such unhealthy behaviours can further worsen the allostatic overload produced by life challenges that exceed the person's ability to cope with them.

4 | PSYCHOLOGY OF REASONING AND DECISION MAKING AND NURSING SCIENCE

Psychology of decision making is a branch of psychology, which studies the cognitive processes underlying individual choices and, more specifically, the process of making a choice from a number of options to eventually achieve a desired result (Lunenburg, 2010). Starting from this definition, making a decision first involves selecting one option from a range of other different options; second, decision making involves more than just the action of selecting one option; and third, the 'desired result' mentioned in the above definition refers to a goal or objective that originates from the mental activity that the decision maker undertakes to arrive at a final choice (Lunenburg, 2010).

4.1 | Historical-conceptual background

Several theories have been developed over the decades to try to explain the decision-making process. The main stages of the evolution of decision-making theory are summarized in [Table 2](#).

Decision theories can be grouped into two main approaches: the normative and the descriptive (Chai et al., 2021; Nibbelink & Brewer, 2018). Normative models try to explain how ideal people should make decisions based on logic and reason; descriptive models try to explain how and why choices are made in the real world. The distinguishing feature is the presence of the principles of logic and rationality, which are characteristic elements for normative models, but are often absent in descriptive models.

Among descriptive theories, the Prospect Theory, elaborated by Kahneman and Tversky in 1979, highlights the existence of several violations of the assumptions of the normative theories (Chai et al., 2021; Kahneman & Tversky, 2012; Suhonen, 2007), highlighting the tendency to decide to deviate from logic and analytical thinking. An historical example of the violation from the normative decision theory is represented by the framing effect, described for the first time by Tversky and Kahneman (1981) and largely studied in psychology and medical decision making (for a review, see Kühberger, 1998; Ruggeri et al., 2020). This effect refers to a phenomenon whereby the choices people make are systematically altered by how information is presented and by the language used in the formulation of options (framing), even though the content of such options is semantically the same. The classic decision problem

used to demonstrate the frame effect involved a national health policy decision. Subjects were asked to choose between two treatment alternatives for an 'unusual Asian disease that was expected to kill 600 people'. The two alternatives differed in riskiness (one was a sure thing while the other was risky), but they were of equal expected value. Alternatives could be presented using a positive frame (lives saved) or with a negative frame (lives lost). Despite the exact same content, using different frames leads to a preference reversal. This and other experiments demonstrated that decision making is affected not only by the value of the options' outcomes but also by other variables, such as how information is presented and processed, events are interpreted, the mental representation of the problem is constructed, by the individual's reference point, previous experiences, reasons for choosing, by the decision maker's thinking styles, as well as the time constraints available for decision making (Chai et al., 2021; Mazzocco & Cherubini, 2010; Roetzel, 2019). These findings support the idea that the information processing underlying decision making is not always analytical and exhaustive, but may use more intuitive, automatic and imprecise thinking. These two thinking modalities, called also System 2 and System 1, respectively, have been studied and integrate in the dual-process theories (Evans, 2009; Kahneman & Tversky, 2012; Stanovich & West, 2000).

System 1 is described as intuitive, experiential, implicit, automatic, or heuristic (the label depends on the specific theory of reference): Information processing takes place quickly and with minimal cognitive effort. Context, task complexity and the decision maker's feelings or emotional reactions play a key role in guiding information

TABLE 2 Main stages of decision-making theory's evolution.

Date	Theory	Theory's core concept	Theorist
1944	Expected utility theory	The central classical notion of rational decision analysis. It refers to the subjective value that individuals attach to each outcome of a choice option multiplied by the probability of occurrence of that specific outcome.	von Neumann and Morgenstern (Chai et al., 2021; von Neumann & Morgenstern, 2007)
1970	Bounded rationality	Expected Utility does not have psychological validity since it is unable to describe and predict the actual behaviour of the decision maker. Individuals generally make satisfactory choices, even when they do not turn out to be optimal choices.	H.A. Simon (Simon, 1956, 1979)
1972	Heuristics and biases research program	A descriptive approach to decision-making that consists of invoking heuristics (mental shortcuts) to explain systematic deviations from rational choice behaviour.	Tversky and Kahneman (Kahneman & Tversky, 1973)
1974	Dual process theory	Information processing follows two distinct types of pathways represented by two distinct systems of thought: intuitive and analytical.	Wason and Evans (Evans, 2009; Wason & Evans, 1974)
1979	Prospect theory	It is a descriptive theory that highlights the existence of several violations of the assumptions of normative theories (e.g. the frame effect and preference reversal). Substitution of 'utility function' with 'value function'	Kahneman and Tversky (Kahneman & Tversky, 1979)
1981	Cognitive continuum theory	The two thinking systems (intuitive and analytical) are located at the extremes of a cognitive continuum and gradually go into increasing balance as they proceed from the extremes to the midpoint of the continuum	Hammond (Cader et al., 2005; Hammond, 1981)
2009	Dual process theory in medicine	Adapted from psychology literature, it describes how clinicians think when reasoning through a patient's case.	Croskerry (Croskerry, 2009)

processing and interpretation. In contrast, System 2 is analytical, rational, explicit, slow and deliberative and involves formal reasoning patterns (typical of deduction-abstraction) and exhaustive information search in order to make the outcome robust and reliable.

One of the implementations of the dual process theory in health care was proposed by Croskerry (2009) to describe the diagnostic process in health care professionals (Croskerry, 2009). Croskerry's model echoes the coexistence of the two thinking systems and the importance of individual and contextual characteristics, adding that the practitioner's expertise influences the type of system used. Specifically, the greater the expertise, the more likely System 1 will be used (Croskerry, 2009).

4.1.1 | The influence of PRDM on nursing science

Psychology has always occupied a prominent position in the history of nursing theoreticians. Several theorists complemented their educational background with studies in psychology, as, for example, the theorists mentioned in the previous paragraph about *The influence of PNEI on nursing science*, and that adopted a broader perspective to understand and define the person and nursing. However, still reasoning and decision-making tend to be heuristic and biased.

4.2 | Key concepts of PRDM: Heuristics and biases

The activation of the heuristic process is unavoidable also in health care professionals: the limited capacity of human memory and attention, the limit number and ambiguity of available information, and time constraints may impede the activation of the analytical thinking process favouring judgement and decision making through the recognition of familiar patterns. Even a single piece of information can activate a mental category if that association has been repeated systematically in the practitioner's experience (Chen et al., 2016; Croskerry, 2009). Previous experiences and the outcome of previous decisions may reinforce patterns and choices independently of the specific relevance of those past experiences and outcomes for the current situation (Mazzocco & Cherubini, 2010). In this line, Thirsk et al. (2022) pointed out that heuristics and cognitive biases, such as anchoring heuristic, belief perseverance and confirmation bias may impede the rational override and the calibration of System 1 by System 2 (Thirsk et al., 2022). In particular, Al-Moteri et al. (2020) demonstrated that nurses could become 'trapped in their assumption and fail to update an earlier conclusion in the light of subsequent information' (Al-Moteri et al., 2020). This last concept has been largely studied in economics first and then in psychology (Grosskopf & Nagel, 2007; Mazzocco et al., 2013; Nagel, 1995), showing a difficulty in integrating new coming information in the mental representation of the problem constructed at the beginning of the reasoning process.

In a complex, dynamic, changing situation as a deteriorating patient in an overloaded nursing environment, it is of paramount

importance to develop a conceptual model that helps practitioners deal with both the complexity of care described by PNEI and with the intrinsic constraints of reasoning and decision making. Clinical reasoning and decision making contribute to define the nursing clinical judgement necessary to reach a clinical conclusion in patient care. In the Connor and colleagues concept analysis (Connor et al., 2023), indeed, the nursing clinical judgement is: 'A reflective and reasoning process that draws upon all available data, is informed by an extensive knowledge base and results in the formation of a clinical conclusion' (Connor et al., 2023). However, the aforementioned limits of the decision maker's working memory imply constraints in the evaluation of a large number of information and problems, which leads the evaluator to focus on the information perceived as the most relevant. According to Johnson-Laird (2010) and his mental model theory the information made explicit in the context is the one that will be more likely to be considered relevant, in disfavour of the information that is implicit because not known, not asked or hidden (e.g. within the mind or body of the patient). In other words, the nurse will never know, for example, the presence of depression in a patient who lost the husband a few years earlier, if the nurse does not ask the patient about the mood and the reasons for that mood, and the information remains implicit even though possibly relevant for defining a priority.

In order to have an accurate reasoning and decision-making process, given the cognitive limits, we need to make the information explicit and relevant. PNEI may be the approach that helps make explicit information that could remain implicit. In the next paragraph, the authors try to integrate the knowledge and instruments from PNEI and PRDM to improve nursing clinical judgement and prioritization.

5 | IMPLICATION OF PNEI AND PRDM IN NURSING

According to the theoretical description of these disciplines, PNEI highlights the relevance of the interaction among several biological systems, the mind and the environment in the understanding of an evident explicit problem. This suggests that an evident and emphasized symptom (a pain, for example) could be only the tip of the iceberg, requiring a deep exploration to better identify the clinical priority problem. PRDM alerts the reasoning process that a nurse could activate to take care of the patient reporting pain. Depending on how the patient presents pain, on time pressure, on how many other cases the nurse met with the same clinical presentation, the nurse's clinical conclusion could be impaired by a heuristic thinking. Emblematic for understanding the weight of heuristic cognitive processes in nurses clinical practice is the clinical case of a young man with post-surgery pain described by Acquaviva et al. (2013) and reported by Thirsk et al. (2022). The trajectory of the patient presented all the information needed for a correct diagnosis and the definition of priorities. Nevertheless, nurses and physicians demonstrated an inability to use System 2 and an excessive reliability in the first recognized patterns. The two main hypotheses that clinicians made for

this young patient were, first, pain as a sign of a regular post-surgical condition and, secondly, the presence of gas in the intestine. Both hypotheses were followed by prescriptions that were incongruent with other present signs and symptoms, sometimes also noted on the patient's chart, but definitely ignored in the priority definition. In particular, Toradol was prescribed to reduce pain, despite the lack of urine output. Additionally, nausea that originated since the Toradol prescription was not integrated into the mental representation of the problem to update the initial hypothesis. Subsequently, a walk was prescribed (despite the increase in patient pain that was 5 on a scale of 5, and an increase in weakness), congruently with the gas hypothesis. Few days later, an intestinal perforation occurred that caused a high fever, a high pulse, a high respiratory rate, pallor and a distended belly (Acquaviva et al., 2013). Again, all these factors were not used by clinicians to defocus from their initial hypotheses: the mental representation of a young healthy man that underwent a successful surgery was a typical reasoning outcome of the representative and anchoring heuristics (Kahneman et al., 1982).

Then, combining the evidence coming from PNEI and PRDM, the main implication for nursing practice is the relevance of an extensive and accurate dynamic assessment that can obtain enough data to illustrate the patient-environment interaction and verify individual available patterns.

5.1 | Nursing assessment

As reported in a systematic review in *Nurse Education Today* (Tan et al., 2021), the patient assessment lacks some important data collection. Specifically, except for monitoring of vital signs and general observations, nurses do not perform an objective examination that may lead to a more accurate diagnostic process. A possible explanation for why nurses do not perform objective examination is the nonunderstanding of the utility of this activity, being rather perceived as an activity that falls outside the nursing domain. Similarly, data on environmental and social aspects should be assessed in a more systematic way.

Taking into account what was described above, integrating the PNEI approach nursing assessment should be a 'Comprehensive Clinical Assessment (CCA)' aimed at collecting anamnestic, clinical and biological elements and their interactions (see Box 1 for an example of different possible nursing assessments in the same clinical case).

Anamnestic elements guide the investigation of the physical and psychosocial environments of patients and how they are perceived by patients: knowing that a patient, Lucy, lost her husband a few years before can foster other data gathering relative to Lucy's relationships, daily habits and psychological states. Exploring the opinions of the patients' beliefs about their health, disease and lifestyle is also essential, since personal beliefs shape behaviours and reactions to life events, other than the immune system (Koban et al., 2021; Sturmburg, et al., 2019). Integrating information on the patient's context with information about symptoms, signs and

clinical problems expressed by patients offers a more complete and accurate picture of the patient's current clinical condition.

Following anamnestic data gathering, clinical and biological data are those collected by objective examination of the patient and analysis of their biological markers. These are crucial in the PNEI approach since they are informative for the possible presence of allostatic overload (e.g. C-Reactive Protein, IL-6, Fibrinogen, High-density lipoprotein, Haemoglobin A1c, Total Cholesterol, Waist Hip Ratio, BMI, Glucose, systolic blood pressure, diastolic blood pressure, heart rate, quality of sleep) (Beese et al., 2022), an information that, together with information from the context, helps the nurse define the nursing priority.

The amount of data provided by the CCA is extensive, and nurses must be able to integrate these data, to discover their interconnection, and to identify what is relevant to the patient's healing process, and then to decide the nursing care priority (Milani et al., 2023). For example, pain, dyspnea and sleep disturbance could be interrelated clinical problems if the patient presents a rib fracture: the fracture may create pain during chest expansion and forces the patient into an antalgic posture that prevents good sleep. It is obvious that the nurse should act to solve pain as a priority because this will consequently be able to solve the other two problems. In the current real context and in the PNEI approach, the clinical pictures that nurses must face are usually more complex. How did the patient fracture their rib? is this the first fracture or has the patient suffered others? what is the meaning the patient attaches to this fracture and pain? What will be the impact of this fracture on its physical and psychosocial context? Several scenarios can open: an abused woman, or an elderly man living alone with walking problems, or a worker who fell from a scaffold, or again a cancer patient with bone metastases, or a young with low socioeconomic status with nutrition deficiency, and so on. In all of these patients, the pain must be resolved, but the definition of nursing priorities in the healing process will be different, and CCA can help nurses in the decision-making process.

The search for exhaustive information and the mandatory step to identify the possible relationships among them forces the use of System 2 and the formulation of alternative diagnostic hypotheses mitigating the risk of errors.

The CCA is even more important if we think that, in addition to the complex and dynamic clinical condition of the patient, also the complexity of the workplace, with reduced inpatient time and nursing shortages (Lake et al., 2009; Zhao et al., 2021) may impede the calibration of System 1 by System 2. Considering again the clinical case of a young man with post-surgery pain described above, two psychological effects leading to suboptimal decisions are present: group thinking and the authority gradient. Group thinking is the tendency for cohesive groups to become so concerned about group solidarity that they fail to critically and realistically evaluate their decisions and antecedent assumptions (Park, 1990). The authority gradient regards people of the health care team that are not empowered to speak up and participate in reasoning and decision making (Cosby & Croskerry, 2004). These could be two main obstacles in the use of System 2. In fact, a nurse of the team caring for the young

BOX 1 Case vignette (from a real case)

Anna is a 46-year-old woman affected by Hashimoto's thyroiditis, coxarthrosis of the pelvis and right hip and L5-S1 discopathy.

Admitted to the hospital, Anna reported severe pain to the hip with impairment of walking, making her daily life difficult and affecting her work activity and social life. Since the prescribed pharmacological treatment was not effective, during this admission, she started local infiltrations. She was discharged without any further suggestions to manage the problem.

Few months after the conclusion of local infiltrations, Anna returned to the hospital complaining that the pain was still very severe, with in addition low mood due to the inefficacy of the proposed treatments. Anna underwent an MRI scan, which result was comparable to the previous one. The doctor changed her pharmacological therapy and lists her for surgery.

How have priorities been defined and how they could have alternatively been defined?

In order to understand how nursing priorities could have been defined, three main theoretical frameworks on priority definition will be used to support the reasoning.

Hypothesis 1. According to a systematic review on the definition of priorities (Hendry & Walker, 2004), priority setting can be defined as the ordering of nursing problems using notions of urgency and/or importance, in order to establish a preferential order for nursing actions.

Following a backward reasoning process, given the proposed treatments (pain killers first, then infiltrations and finally surgery) we can infer that the most urgent and important problem was pain.

Cognitive process

Given the priority definition, attention must be allocated to all patient's problems, then put them in a list and decide what is the most urgent or relevant.

Result

The hypothetical list of problems could be as follows: pain, walking impairment, compromised activities of daily living, social and job difficulties and low mood.

Once identified the problems, the nurse must have decided that pain is the first problem that she has to take care of: she can administer pharmacological treatment, suggest antalgic postures, integrate with nonpharmacological treatment, including cognitive pain management techniques.

Hypothesis 2. A different theoretical framework, proposed by Alfaro-LeFevre (2001), posits that 'it is important to place a high priority on problems that contribute or cause other problems'.

Even according to this framework, using a backward reasoning process, the problem to be prioritized was pain.

Cognitive process

Given the priority definition, attention must be allocated to all patient's problems, then to the relationship among them and finally decide what is the problem that causes the others: this is the priority.

Result

The hypothetical list of problems that the nurse identifies are: pain, walking impairment, compromised daily life activities, social and job difficulties, low mood.

Looking for a causal relationship among each other, the nurse decides that pain is the first problem that the nurse has to deal with. Pain causes impairment in walking that compromises activities of daily life that negatively impact work and social life and ultimately impact patient psychological well-being of the patient.

The nurse could administer pharmacological treatment, suggest antalgic postures, integrate with nonpharmacological treatment, including cognitive pain management techniques.

Reflection

Despite the fact that the second framework expands to the relationship among problems and reciprocal influence, the attention focused on the problems makes it difficult for the nurse to look for features and factors that are not present and made explicit in the immediate context (Johnson-Laird, 2010). Solid findings from psychology of decision making showed that the decision maker tends to focus and anchor the attention on factors that are present in the specific situation (focusing bias), allowing for the construction of a specific mental model of the problematic situation, with difficulties in defocusing to other relevant but not explicit information

BOX 1 (Continued)

and, as a consequence, making difficult to create an alternative mental model of the situation (Johnson-Laird, 2010). If the problem has characteristics of high intensity, vividness and immediacy (such as pain), then this problem tends to capture most of the attention, making it the most likely to be chosen and leaving less space in the working memory to look for other information (Kahneman et al., 1982).

Furthermore, unless trained, individuals, including health professionals, have poor skills in seeing forward or backward multiple consecutive event-outcome cycles (Mazzocco et al., 2013).

For this reason, a definition of priority should be wider and include not only problems and their connections but also other types of information that allow the decision maker (the nurse in our case) to defocus from a single aspect (in our case, 'problems') and to build alternative mental models of the situation where resources are considered in addition to problems. Accordingly, hypothesis 3 is proposed and is based on the visit she had with an integrative nurse while waiting for surgery.

Hypothesis 3. According to the theoretical framework based on PNEI, whose distinctive feature is the physiological interactions among the brain, the behaviour, the immune and endocrine systems and the environment, the priority must be found in the relationship existing among all domains of variables. Nursing priority is the variable that most likely affects all other variables related to the patient.

Cognitive process

Unlike Alfaro-LeFevre (2001), the PNEI approach does not look only at problems, but at all the patient's information, exploring all the factors that could have produced the allostatic overload. If the patient is undergoing systemic and local treatment, why is this pain still present and so severe? What is maintaining inflammation and allostatic load? The response to this question is the priority in Anna's case.

From a cognitive perspective, the decision maker's ability is to update the mental model of the situation every time new information is obtained.

Result

Following this approach, the nurse identifies these problems: pain, walking impairment, compromised daily activities, social and work difficulties, low mood.

The nurse also identifies these resources: Anne is a compliant patient, she has good social support, a very supportive family with an attentive husband and a good son; she lives in an area without too much pollution, she had not a sedentary lifestyle before experiencing pain, she loves her job, she has healthy nutrition habits.

The problems and resources are then considered throughout the evaluation of the connections among them. Widening the exploration of Anna's social life, the nurse wants to discuss possible events that could have led to an increase of allostatic load, therefore inflammation and hence pain. Any information that is apparently not related to the problem can indeed help the nurse understand the problem. Discussing with the patient about what happened before the pain arose and if there was something that creates stress in her life in addition to pain can bring new relevant information on Anna's psychoneuroendocrinological process that led to pain.

Anna tells about a new colleague with whom she has conflicts. After other questions and inquiries, the nurse discovers that Anna is still suffering from a miscarriage that happened several years before. Interpersonal loss has been found to have an impact on the activity of the sympathetic nervous system (SNS) and HPA axis, which can interact with genetic, psychological and social-environmental factors that contribute to immunological dysregulation and increased inflammatory activity. The nursing priority is the psychological well-being of the patient, which can reduce allostatic overload and inflammation, contributing to reduce pain. In addition, since coxarthrosis is a consequence of a degeneration process that affects the articular cartilage lining the surface of the acetabulum and femoral head, then nurse can also suggest Anna to support her healthy nutrition assuming hydrolyzed collagen and Elastin and Vitamin C that contribute to normal collagen formation, promoting proper function of bones, cartilage and skin. All other interventions hypothesized in the two previous scenarios could be added.

Anna started psychological therapy and over the course of the next few months, her pain improved, she started water aerobics and went back to walking reducing also medications. She got her life back and never underwent surgery.

This real case is very simple, but teachable ones. As psychology of decision making teaches, nurses and in general health care providers, especially if they are experts, resort predominantly to intuitive thinking. The intuitive cognitive process tends to focus on a few pieces of information, those considered most relevant.

BOX 1 (Continued)

In this clinical case, pain activates the nurse's pattern because it is an explicit and immediately accessible information: it is considered relevant for healthcare providers, but also for the patient, it is also the most explicit cause of other manifest problems.

The PNEI approach can interrupt this automatic thinking, requiring nurses to ask what is causing or maintaining the patient's allostatic overload. This question does not focus on problems, rather it requires a more comprehensive nursing assessment of individual and environment that must be integrated with biological knowledge to identify the hidden physio-pathological correlation that could explain the nursing clinical picture. More details on the Comprehensive Clinical Assessment based on PNEI approach are described in the text.

patient tried to highlight the possible presence of a problem, but was not able to carry on her position and finally conformed to the thinking of the group. The CCA might overcome the negative effect of group thinking and authority gradient by providing a more structured exhaustive and reasoned process that might increase confidence of the single professional.

Moreover, among the factors affecting the complexity of the workplace, worthy to note is also the number of patients a nurse should care for during a shift, with the potential for new unforeseen and competing or even conflicting care demands. In this context, an effective identification of nursing priorities throughout the CCA becomes essential to distinguish the problems that require immediate action from those that can be postponed since not deemed urgent or relevant (Alfaro-LeFevre, 2001; Bowers et al., 2001; Hendry & Walker, 2004; Schubert et al., 2021).

In the nursing literature, the concept of nursing priority is related to the concepts of time and relevance. More precisely, nursing priorities are divided into: (1) the most urgent thing to do (time); (2) the most relevant thing to do (relevance); and (3) the most urgent and relevant thing to do (co-presence of both) (Bowers et al., 2001). This conceptualization of nursing priority is the result of research studies on implicit rationing of nursing care, in which nurses decide not to perform certain activities or tasks due to a lack of time. The non-performed activities (missed care) are used to describe what is priority for the nurses without particular emphasis on the cognitive processes underlying the priority identification and without considering results from the complexity science as we previously showed in the clinical case of the patient with a rib fracture.

5.2 | Nursing care plan

Based on the previous scenarios on the patient with a rib fracture, it is evident that nursing care plans will be different from patient to patient, but what can PNEI and PRDM add?

First of all, as we have pointed out previously, in the PNEI framework, the main nurse's objective is the implementation of health and not only the management of diseases or problems. In this perspective, the resolution of pain and dyspnea cannot be enough: it will be mandatory to investigate the potential allostatic

overload. Adopting a PNEI approach induces the nurse to defocus from the pain problem (the explicit information) to look for implicit nondirectly related information that may inform the nurse on the possible multiple consequences of the decision. Choosing the apparent simpler scenario, a worker fell from a scaffold—the CCA could highlight that he lives in a working-class neighbourhood, has three young children, and his wife does not work. In addition, he has a precarious job and sometimes he works as a warehouse worker at night at the market to boost his salary, and eats junk food. Blood pressure measurement and blood sample collection show systolic, diastolic blood pressure and blood sugar levels above normal ranges. All data would support the hypothesis of an allostatic overload. Anticipating the possible consequences of the priority decision on general health and quality of life and the further consequences of a resolution of pain, it is possible to understand that the management of the rib fracture and related signs and symptoms could not improve his general health conditions. In fact, a mere reduction in pain may cause the patient to ignore the fracture and return to work for fear of being fired, perhaps risking pneumothorax. Nursing care priority could be a different one: asking the patient to keep a diary of blood pressure measurements to verify if the hypertension is occasionally due to pain or if it is a disease that can have caused the fall. Furthermore, considering that the allostatic burden appears to be related to disadvantaged socioeconomic conditions, lower educational level, ethnic discrimination and work-related stress (Guidi et al., 2021), another nursing priority could be the psychosocial context, that lead to ask for an integrative intervention of the psychologist and the social worker to reduce the effect of environmental factors. Finally, an educational nursing intervention will be necessary to explain his high risk of developing chronic disease together with possible strategies to reduce stress by improving lifestyles and sleep quality, thus reducing the risk of the chronic disease.

5.3 | Nursing theoretics

Taking into account the PNEI's perspective, priority should be based on the concept of 'interaction' rather than on the problems themselves and, more specifically, the relationship existing between different variables (information, signs, symptoms) collected during the

patient's CCA. The analysis of the interactions among variables is the nudge for the use of analytical reasoning and decision making that eventually facilitates the emergence of the factors affecting the problem and of the potential future outcomes. Following this perspective, nursing priority can be defined as the variable that most likely affects all other patient-related variables. If among different variables there is no one presenting a higher influence on others, the variable that will assume a connotation of priority is the one that shows the traits of clinical urgency, patient relevance, or resolution of immediacy. This new definition may facilitate the process of anchoring the concept of priority on the patients rather than on the set of interventions, actions and decisions put in place to take care of them and that are the inevitable consequence of the specific priority identification. Instead, today nurses seem to prioritize aspects of care that are more task-oriented than person-centered (Mantovan et al., 2020).

6 | DISCUSSION

The present work discussed the importance of looking at the complexity of human beings and their living contexts, exploring the conceptual frameworks of two disciplines—PNEI and PRDM—to illustrate their potential usefulness in ontological nursing development. While PNEI offers the scientific evidence to look at the person (and the patient) abandoning the reductionist approach and looking at the connections among different systems (biological, psychological, social and environmental), PRDM provides knowledge and strategies to reason on a dynamic interconnected informative context (e.g. sign and symptoms in a young deteriorating patient) and to overcome the limits of System 1 by forcing the use of System 2.

Despite the tendency that appears to confine nurse's role in a compendium of tasks, it is on the contrary characterized by continuous, dynamic and complex decision making. Therefore, the decision making process remains one of the most important tools that guide the nurse in evaluating, assimilating, or discarding components of information to make sound judgements in clinical and non-clinical situations often characterized by activity overload and conflict (Johansen & O'Brien, 2016). However, considering the power of the heuristic thinking when deciding in uncertainty conditions and the influence of information context on activating the analytical versus the heuristic thinking, the paramount importance of PNEI approach is evident. The adoption of a PNEI approach forces the search for multiple information and force to look for connection that nudges for the use of analytical thinking reducing biases and missing care and improving quality of care.

In conclusion, despite research on implicit rationing in nursing care can provide important information on its negative impact on patient safety, quality of care and the professionals' well-being, the implicit rationing cannot be considered a proxy variable to define, measure or teach the nursing prioritization process that is a complex

decision-making process in its own right (Masiero et al., 2018; Zhao et al., 2021).

7 | CONCLUSIONS

According to the Institute of Medicine, poor healthcare decision making has been associated with up to 98,000 patient deaths annually (Nibbelink & Brewer, 2018). Therefore, it is of paramount importance to foster an adequate decision making process in nursing clinical reasoning based on the most up-to-date scientific evidence. To reach this aim, nursing theoretics seems to be the predominant strategy. Indeed, although people have been shown to reason irrationally, the tendency to be prone to bias can sometimes be greatly reduced by changing the way a problem is formulated. Considering that theoretics defines the frame of the problem, this article proposes a new theoretical nursing perspective, using PNEI and the PRDM knowledge to support nurses' cognitive processes in correctly representing each clinical situation.

Meleis—a scholar of nursing theories—posits that the maturity of a discipline is a prerequisite for entering the development of interdisciplinarity without getting lost (Meleis, 2017). Nursing is ready to take advantage of the contribution of PNEI and the PRDM to improve the competencies necessary to make individualized, high-quality nursing care decisions that focus on the highest possible health benefit, even in settings of chronic diseases.

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