NURSING FORUM AN INDEPENDENT VOICE FOR NURSING

A Concept Analysis of Systems Thinking

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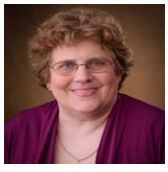
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PURPOSE. This concept analysis, written by the National Quality and Safety Education for Nurses (QSEN) RN-BSN Task Force, defines systems thinking in relation to healthcare delivery.
METHODS. A review of the literature was conducted using five databases with the keywords "systems thinking" as well as "nursing education," "nursing curriculum," "online," "capstone," "practicum," "RN-BSN/RN to BSN," "healthcare organizations," "hospitals," and "clinical agencies." Only articles that focused on systems thinking in health care were used. The authors identified defining attributes, antecedents, consequences, and empirical referents of systems thinking.
FINDINGS. Systems thinking was defined as a process applied to individuals, teams, and organizations to impact cause and effect where solutions to complex problems are accomplished through collaborative effort according to personal ability with respect to improving components and the greater whole. Four primary attributes characterized systems thinking: dynamic system, holistic perspective, pattern identification, and transformation.
CONCLUSION. Using the platform provided in this concept analysis, interprofessional practice has the ability to embrace planned efforts to improve critically needed quality and safety initiatives across patients' lifespans and all healthcare settings.

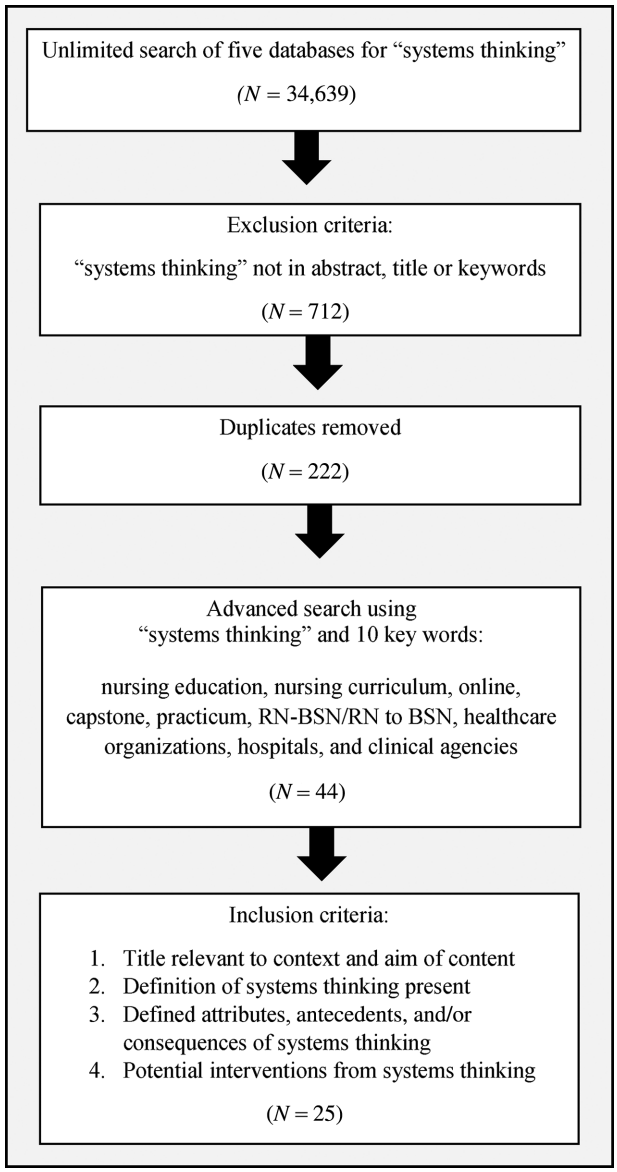
This article provides an evidence base for interprofessional practice to improve patient outcomes in a complex healthcare delivery system using Walker and Avant's (2011) approach to concept analysis.

A basic search through EBSCOhost and PubMed was completed. Five databases were selected according to the likelihood to identify systems thinking in the interprofessional literature. The five databases were the Cumulative Index of Nursing and Allied

Health with full text, Academic Search Premier, PsychINFO, Educational Resources Information Center, and PubMed. An unlimited search using the keyword "systems thinking" was performed (N = 34,639). All sources of evidence were considered if "systems thinking" was not present in the abstract, title, or keywords, the article was excluded. A total of 712 articles were retained. After 222 duplicates were removed; 490 articles remained. The National QSEN RN-BSN Task Force reviewed the articles for relevancy, engaged in discussion, and decided to add other keywords to narrow the search.

A narrowed advanced search through EBSCOhost and PubMed using "systems thinking" combined with one of the following keywords was completed: nursing education, nursing curriculum, online, capstone, practicum, RN-BSN/RN to BSN, healthcare organizations, hospitals, and clinical agencies. A total of 44 articles remained and authors reviewed the articles according to the title relevance to the context, aim of the content, definition of systems thinking, defining attributes, antecedents, outcomes, and potential interventions. After review, the authors eliminated 19 articles that did not meet the inclusion criteria, keeping 25 articles (Figure 1).

Figure 1. Flowchart of search process



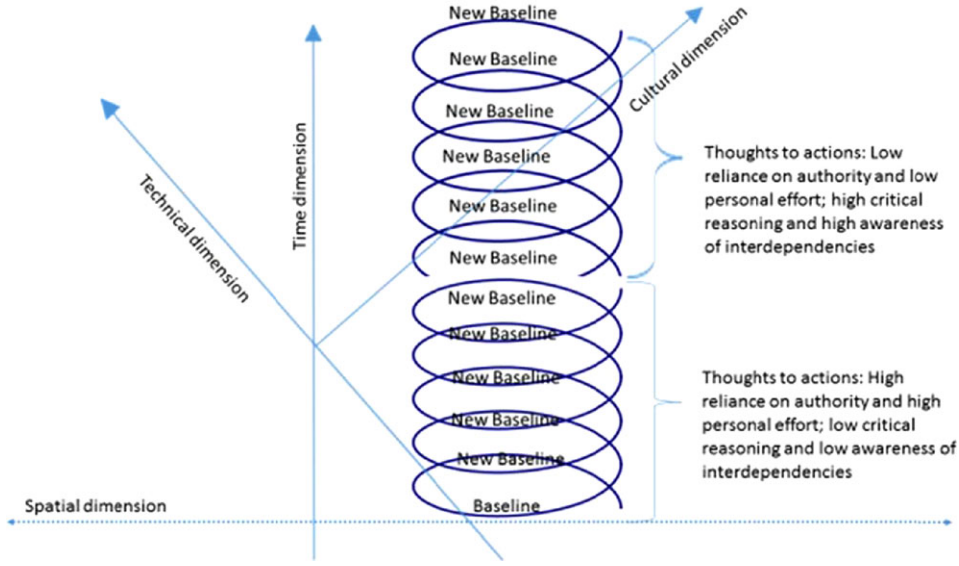
Definitions and Uses of the Concept

Systems thinking, a two-word grouping of ideas, can be explained by definitions and conceptualizations of each word. According to Oxforddictionaries.com (2016), the definition of *system* is "a set of principles or procedures according to which something is completed; an organized scheme or method." According to Merriam-Webster.com (2016) *thinking* is a "process of using one's mind to consider or reason about something." The authors' conceptual definition of *systems thinking* is: a set of organized parts from which to process deliberate reasoning.

A historical review of the epistemological use of systems thinking begins with Von Bertalanffy (1968), who conceptualized systems as a set of interacting or interdependent component parts forming a complex whole. He proposed the ultimate complexity of a system was a micro or macro unit of a greater or lesser whole. Grand nursing theorists envisioned four metaparadigms as living systems (person, health, nurse, and environment), with each explained as being greater than the sum of their parts. Interplay or synergy among the metaparadigms was that the whole person expressed health when connected with physical and social environments as mediated through the nurse (Blais & Hayes, 2015).

In educational and systems literature, thinking can be viewed as a deliberate cerebral process that precedes action. Multiple word combinations describe the process: critical reasoning, critical thinking, and clinical reasoning (Benner, Sutphen, Leonard, & Day, 2009). Wiggins and McTighe (2011) explain the process of *thinking and doing* as educator-led, anchored by core professional competencies, and intentional

Figure 2. The helix of systems thinking



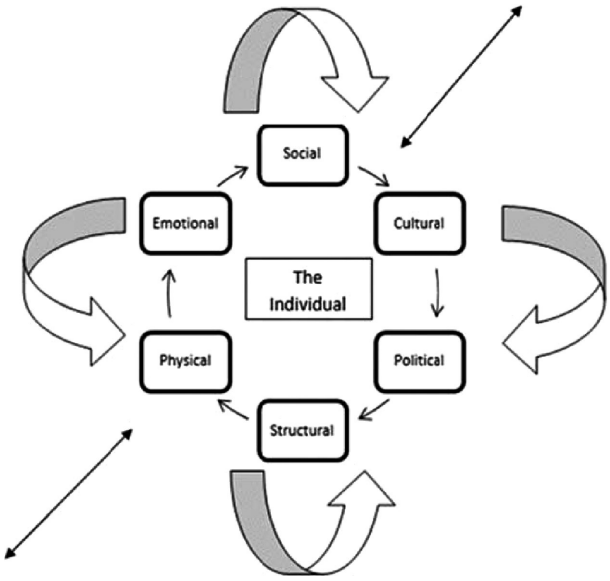
transference of essential knowledge to real-world applications of systems thinking.

The review of the literature identified four contemporary conceptualizations of systems thinking. First, Senge (2006, 2014) portrayed systems as a circular image similar to a coiled snake. He explained systems thinking as being influenced by the context of time and space. Senge (2006, 2014) presented the ideas of personal mastery and mental models. Personal mastery infers proficient use of objective observation to fine-tune intuition of reality. Mental models are cerebral images of past learned knowledge that influences action. Thus, the coiled snake grows in length over time, but each reality never occupies the same space, so the coil grows in diameter. Second, Oshry (2007) expanded the conceptualization of systems thinking to include social, technical, and cultural contexts that influence thinking and behavior directly to the environment. Third, Dolansky and Moore (2013) illustrated systems thinking on a continuum, where it is expressed by nursing care as an increasing ability to move from a reliance on authority to interprofessional collaboration; from high personal effort to ease of action; and, from low awareness of interdependence to heightened awareness. Fourth, Phillips, Stalter, Dolansky, and Lopez (2016) decided that the Dolansky and Moore (2013) continuum held set points across seven distinctive phases of development in systems thinking.

A person's environment is linked to his/her behavior through systems thinking. That is, how nurses assess their personal knowledge, skill, and ability is influenced by the physical layout and procedures of the workplace. Dolansky and Moore (2013) proposed that because most nurses provide care in complex settings, they have the opportunity to reduce accidents, enhance decision-making, and engage in interprofessional communication to promote safer outcomes. Nurses' abilities to systems think is essential for provision of safe, high-quality care (Dolansky & Moore, 2013). Phillips et al. (2016) suggested nurses can be taught to increase system thinking over time through experiences.

Using the conceptualizations from prior work, the authors created an abstraction (Figure 2) that resembles a right-handed helix. Here, the coil is stretched across time and space, where movement upward occurs over time and builds from previous knowledge based on applied experiences. The helix can move across micro and macro levels, becoming intricate in pattern because the situation never presents itself in the same time or space ever again. New baselines are established with every new situation, and as a nurse advances in experience, a higher level of comfort in decision-making and

Figure 3. Continuum of Complexity



interdependence occurs. Figure 3 provides a view where whole individuals exist within the center of the helix. In essence, systems thinking *is what occurs when the individual's social, cultural, physical, emotional, and political attributes change the system but at the same time are changed by the collective nature of the system.* The lines are an intersection of time. Time infers individuals have levels of experience and familiarity with the system. So, as one *comes to know the system, one comes to know the self*. Therefore, both the system and the individual grow on a continuum. Ultimately, in the context of interprofessional practice an operational definition was evident: Systems thinking is a process applied to individuals, teams, and organizations to impact cause and effect; where solutions to complex problems are accomplished through collaborative effort according to personal ability, with respect to improving components and the greater whole.

Defining Attributes of Systems Thinking

According to Walker and Avant (2011), attributes are defined by the *repetitively present characteristics identified when* the concept is used. The defining attributes of systems thinking are characteristics that were repetitively present when systems thinking was utilized. The defined attributes include a dynamic system, holistic perspective that identifies all aspects of the dynamic system, seeks to identify patterns, and is nonlinear and transformative.

Dynamic System

Systems thinking functions on a continuum that ranges from an individual to larger environmental components (Dolansky & Moore, 2013). It involves awareness of and consideration for the interaction, synchronization, and integration of people, processes, and technology among dynamic and fluctuating systems (Kroelinger et al., 2014; Trbovich, 2014). Systems thinking occurs on a continuum that considers both "upstream" and "downstream" (Bleich, 2014a); yet, it is nonlinear (Serim, 2001; Weiman & Wieman, 2004).

Holistic Perspective

Systems thinking encompasses a need for an interprofessional approach that identifies all aspects of the dynamic system, incorporating biological systems, organizational systems, and political systems, as well as the subsequent interconnections with all system components (Leischow & Milstein, 2006). It distinguishes and analyzes behavioral, physical, cultural, technological, and social impacts of the system with a recognition of the interrelated relationships among system structures and processes (Bocoum, Kouanda, Kouyate, Hounton, & Adam, 2013; Habron, Goralink, & Thorp, 2012; Kroelinger et al., 2014), looking beyond the root cause of an event (Chuang, Howley, & Lin, 2015) with a collective view rather than an individualistic view (Dolansky & Moore, 2013; Gilson, Elloker, Olckers, & Uta, 2014) facilitating the analysis of complex ideas in a holistic manner.

Seeks to Identify Patterns

Systems thinking utilizes critical thinking with a multifaceted inquiry that seeks to identify patterns within a complex situation (Evans, Huxley, Maxwell, & Huxley, 2014; Kroelinger et al., 2014). The recognition of a ripple effect from one system component to another system component also considers potential feedback loops within the recognition of patterns (Bocoum et al., 2013; Kroelinger et al., 2014).

Transformative

Systems thinking is transformative through the use of insight, self-examination, and action (Krejci,

1997) as data become information advancing to knowledge (Bleich, 2014c). The collaborative relationships and commitment to improved change fosters a proactive, not reactive response. Senge (2006) described this transformation of the individual through personal mastery, mental models, and shared vision. As stakeholders come together with their collaborative system view, an opportunity to act on their commitment to transformative change emerges (Gilson et al., 2014). While the potential for either positive or negative change exists (Weiman & Weiman, 2004), collaboration maximizes positive effects while minimizing unintended negative effects of change (Swanson et al., 2012).

Antecedents and Consequences

According to Walker and Avant (2011), antecedents occur *before* the concept. In order for systems thinking to exist, the following antecedents must be present among individuals, teams, and the environment. An extensive list of antecedents ($N = 25$) and consequences ($N = 38$) were derived from the literature review. The Donabedian Quality Framework (1988) of structure, process, and outcomes was used to organize themes. Structures are defined as baseline situations (foundational and situational); processes are defined as factors that impact care among individuals or teams in the system. Antecedents are synonymous with structures and processes and outcomes are synonymous with consequences.

Antecedents

Five foundational, five process, and three situational antecedents were identified that provided a deeper understanding of the system. A foundational antecedent is defined in this analysis as antecedents through which an individual structures personal understandings and meanings of the system and includes recognition of the self, system awareness, and the interplay of the self within the system. A situational antecedent is defined as insight and action that influence an individual's problem resolution within the system. Situational antecedents begin with identifying a lack of coordination of holistic, proactive interprofessional practice (IPP) through assessment of the roles and impact of individuals, groups, aggregates, and populations within the system (Leischow & Milstein, 2006). A process antecedent is defined as using an iterative and systematic process, moving from the identification completed by the individual within the system to a more robust comprehension of the system through interprofessional insight, action, and collaboration (Bocoum et al., 2013).

Consequences

Consequences occur as a *result* of the concept (Walker & Avant, 2011). Consequences ($N = 29$) are represented in the Donabedian Quality Framework (1988) as outcomes and may serve as benchmarks for systems thinking. As systems thinking is applied to "dynamic, complex organizations" (Donabedian Quality Framework, 1988, p. 7), the list of outcomes is organized according to transformational impact on individuals ($n = 7$), teams ($n = 5$), and organizations ($n = 17$).

Individuals. Systems thinking results in transformation of the individual occurring as a result of better patient-centered care. The worldview of the patient is broadened by "knowing how, why, and where the system either functions or fails" (Bleich, 2014c, p. 247). It also includes healthcare providers gaining an understanding of intended and unintended effects of patient-centered care on the whole system. Healthcare providers' enhanced understandings of system components drive individuals' ethical care and behaviors (MacRae, Fox, & Slowther, 2008).

Teams. Systems thinking results in organizational transformation among teams. More teamwork occurs when healthcare providers seek input from other stake holders, including the interprofessional team and patients (Bleich, 2014a). The use of systems thinking may aid in the reduction of "moral distress and disempowerment among healthcare providers, as well as promote a collaborative approach within the organization or among systems" (MacRae et al., 2008, p. 314).

Organizations. Systems thinking results in organizational transformation that occurs as a result of strengthening organizational and clinical reasoning, facilitated decision-making, and provision of improved IPP to meet patient outcomes (Bleich, 2014c). Systems thinking promotes patient-centered healthcare quality, where the use of system-based clinical ethics supports evidence-based practice (MacRae et al., 2008).

Systems thinking results in a movement beyond patient care errors (i.e., medication error) to centering on the system impact (Bleich, 2014c), toward a just culture that embraces change, and fosters

Table 1. Defining Attributes from Systems Thinking Aligned With Items from the STS

Defining attributes	Items from the STS
Dynamic system	I look beyond a specific event to determine the cause of the problem
	I think understanding how the chain of events occur is crucial
	I consider the cause and effect that is occurring in a situation
	I think that systems are constantly changing
Holistic perspective	I think of the problem at hand as a series of connected issues
	I propose solutions that affect the work environment, not specific individuals
	I keep in mind that proposed changes can affect the whole system
	I consider how multiple changes affect each other
Seeks to identify patterns	I seek everyone's view of the situation
	I include people in my work unit to find a solution
	I think about how different employees might be affected by the improvement
	I recognize system problems are influenced by past events
	I consider that the same action can have different effects over time, depending on the state of the system
Transformative	I consider the relationships among coworkers in the work unit
	I think more than one or two people are needed to have success
	I think small changes can produce important results
	I try strategies that do not rely on people's memory

organizational and team learning (Rodrigues, 2002) without blame. Any cultural change in a complex system impacts outcomes throughout the system (Serim, 2001; Wieman & Wieman, 2004).

Empirical Referents

The final step of a concept analysis is to determine the categories of occurrences that exhibit the existence of the concept (Walker & Avant, 2011). Although several measures of systems thinking (Groh, 2015; Hopper, 2007) exist, only one published systems thinking instrument could be found in the healthcare literature, the Systems Thinking Scale (STS) (Dolansky & Moore, 2013). The conceptual domains and preliminary items for the STS were developed using the literature by a group of international experts ($N = 10$) in quality and safety improvement. Systems thinking was defined by the ability to identify patterns and connections that might reinforce or counteract system components. Components identified as qualities of systems thinking were an understanding that events had multiple causations possible that included feedback and interrelations of factors with patterns of relationships. Factor analyses of items resulted in three distinct factors (System Interdependencies, Personal Effort, and Reliance on Authority). Twenty items weighted high on System Interdependencies (Factor 1). Two items weighted high on Personal Effort (Factor 2) and four items weighted high on Reliance on Authority (Factor 3). The 20 items that measured System Interdependencies were further tested for reliability and validity. Table 1 displays the defining attributes identified from this concept analysis and the items from the STS. Reliance on authority or personal effort subscales were not further tested, as most items did perform as predicted in the factor analysis. Further testing of these other subscales is indicated.

Implications for Interprofessional Practice and Research

Systems thinking can inform direction and provide clarity as to the warranted modifications inherent in the realm of nursing educational arenas, research, and interprofessional practice. Through systems thinking, an individual is transformed, informing a definitive change in the system, through collaboration. Ultimately, interprofessional educational practices need to facilitate systems thinking and its development in the clinical setting. This is important because of evidence that healthcare providers need foundational knowledge to prioritize care, balance multiple patients, and make effective clinical decisions (Fero, Witsberger, Wesmiller, Zullo, & Hoffman,

2009; Hickey, 2009; Li & Kenward, 2006). The Institute of Medicine's (IOM, 2011) *The Future of Nursing: Leading Change,* Advancing Health report called for the transformation in nursing educational practices, as well as interprofessional collaboration to promote improved patient outcomes within the complex healthcare systems. An absence of systems thinking may contribute to threats to patient safety through lack of safe, high-quality coordinated care in interprofessional practice (Dolansky & Moore, 2013). The IOM (2011) report emphasized baccalaureate prepared and experienced nurses as poised for leading care within complex systems using evidence-based practice. Current research utilizes descriptive studies necessitating increasingly complex designs such as educational intervention studies aimed at predicting improved outcomes.

Systems of care in which individuals lack the capability for systems thinking, emerge as fragmented, lacking a holistic patient-centered environment for care, creating the possibility for consequences to patient safety. Most significantly, a lack of systems thinking creates an environment of care in which the patient is viewed as the passive recipient of care, creating further deficits in the whole system in terms of cost of care, financial burden, mortality and morbidity, and declining patient satisfaction. To promote systems thinking, organizations must be committed to the embodiment of a philosophy of ethical practice and a just culture. Additionally, an organizational milieu must exist that promotes open communication among providers and between patients and providers. Organizational systems of health care and interprofessional including RN-BSN education must embrace concentrated efforts to provide those educational and self-development options to facilitate systems thinking environment in not only the novice nurse but also the expert nurse in whom a deficit may be present. Thus, healthcare provider curricula must begin to integrate systems thinking to promote interprofessional collaboration aimed at improving patient outcomes and system effectiveness.

Conclusion

In this concept analysis, nurse educator scholars from the National QSEN RN-BSN Task Force defined systems thinking in the context healthcare delivery using Walker and Avant's (2011) analytical approach. The conceptual definition of systems thinking evolved from an historical assessment of general systems theory through four conventional perspectives (Dolansky & Moore, 2013; Oshry, 2007; Phillips et al., 2016; Senge, 2006). The final definition culminated in a collaborative quality improvement process and evolved into visual models.

Four primary attributes characterized systems thinking: dynamic system, holistic perspective, pattern identification, and transformation. Antecedents and consequences were arranged according to Donabedian's Quality Framework (1988). Defining attributes involved awareness of a situation that could impact quality or safety (Bleich, 2014c; Kroelinger et al., 2014) and may transform individuals, teams, and/or organizations (Bleich, 2014a, 2014b, 2014c; Bocoum et al., 2013; MacRae et al., 2008). Empirical referents aligned defining attributes to constructs measured by the STS.

This concept analysis yields a platform from which interprofessional educators can consider not only emerging pedagogies but also alternative curricular models. Phillips et al. (2016) offer a model to promote teaching systems thinking. Further, researchers have valid tools available to measure educational interventions and systems thinking, such as the STS (Dolansky & Moore, 2013). More importantly, IPP has the opportunity to embrace planned efforts to improve critically needed quality and safety initiatives across patients' lifespans and all healthcare settings.

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