

New ways of seeing: the role of systems thinking when developing competency frameworks in health professions education.

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Author Contributions

AB conceived the paper; gathered, analysed, and interpreted data, and drafted the initial manuscript. BW, MB, ML & WT critically revised the manuscript for important intellectual content, and edited the manuscript. All authors read and approved the final manuscript.

Abstract

Introduction

Competency frameworks provide a link between professional practice, education, training, and assessment. They support and inform downstream processes such as curriculum design, assessment, accreditation and professional accountability. However, a lack of organizing frameworks, and difficulties in representing complex professional practice result in uncertainty regarding the validity and utility of competency frameworks. This necessitates additional ways of “seeing” practice when developing competency frameworks. We highlight what a systems-thinking conceptual framework can offer when developing competency frameworks.

A Systems-Thinking Approach

Mirroring shifts towards systems thinking in program evaluation and quality improvement, we suggest that similar approaches that identify and make use of the role and influence of system features and contexts can provide value when developing competency frameworks. We framed a systems thinking approach first by adapting Ecological Systems Theory (EST). EST offers a realist perspective of the person and environment, and the evolving interaction between the two. Second, we utilized complexity thinking, which obligates attention to the relationships and influences, to explore the multiple complex, unique, and context-embedded problems that exist within the messy, real-world system.

Summary

The ability to represent clinical practice when developing competency frameworks may be improved when features that may be relevant, including their potential interactions, can be identified and understood. A systems thinking approach makes visible features of a practice in context that may otherwise be overlooked in the development of competency frameworks.

Introduction

Competency frameworks provide a link between professional practice, and education, training, and assessment [1]. They support and inform downstream processes such as professional accountability, standard-setting, assessment strategies, and curriculum design [2,3]. However, their development is highly variable across different health professions, in part due to the absence of rigorous development and reporting guidelines leading to some uncertainty regarding their validity or utility [4]. While some of this uncertainty stems from methodological choices during their development, another stems from the absence or limited accounting for the complex nature of healthcare delivery and the elements of competence needed to enact it. Multiple and interrelated issues in healthcare that evolve in response to changes within specific profession, adjacent professions, the larger medical field (e.g. policy), and larger societal movements (e.g., changes in public expectations) contribute to this complexity of representing it all (or as much as possible) in the development of and within competency frameworks.

Researchers have identified that competency frameworks poorly address issues of 21st-century healthcare practice. These include for example the role of technology and virtual care models [5,6],

structural competence [7–9], climate change [10], quality improvement, patient and professional wellbeing [6,11,12], and the role of inter-professional teams and collective competency [6,13,14]. In essence, many competency frameworks fail to accurately represent practice. Some have criticized competency frameworks as representing much of the objective knowledge and skills required for professional practice without also as sufficiently accounting for subjective attributes (e.g., honesty, integrity, self-awareness, personal values), decision-making, critical thinking, self-care and judgment that are integral to professional practice, suggesting they may fail to fully represent the construct of practice [12,15–17]. Further critiques have been levelled at existing competency-based approaches for being overly reductionist, for emphasizing a minimum standard, for failing to account for complexities of context-bound practice, and for restricting innovation and professional development [14,18–20]. When viewed together, these issues suggest that the competency frameworks on which many educational programs and processes are built may be incomplete or inadequate representations of practice.

The downstream effects of incomplete competency frameworks can be significant for education. This can include, for example, an unprepared workforce, problematic assessment models and/or the adequacy of accreditation expectations. One potential solution to address these challenges is to identify the means to better represent practice. Our recent scoping review on the development of competency frameworks in the health professions revealed potential threats to the validity of framework outcomes due in part to a lack of organizing theoretical and conceptual frameworks [21]. In this eye-opener, we will highlight what a systems thinking conceptual framework can offer when developing competency frameworks, and in particular towards addressing the uncertainties that exist in a health professions education context. First, we will explore the implications of complex healthcare work. Then we will highlight how a systems thinking conceptual framework can provide new ways of ‘seeing’ clinical practice and its contexts when developing competency frameworks. Finally, we will illustrate the application of the conceptual framework using emergency medicine and paramedicine as examples.

Implications of the Complex Nature of Healthcare Work

The complex and unpredictable nature of clinical practice presents multiple challenges when trying to represent it in a singular competency framework. Clinical practice varies according to the attributes of the individuals and teams who enact it, is influenced by regional (e.g., legislative or regulatory) variability, and poses complex questions that we need to consider. Different strategies in the competency framework development process have been utilized including grounded theory [22], expertise modeling [17], phenomenology [23], taxonomies [24], and critical ethnography [25]. While these approaches may capture how healthcare professionals care for patients, they may neglect to account for the interactions between the individuals and the broader healthcare environment suggesting core features of the ‘person-in-environment’ interactions may be lost. Social contexts and the sometimes hidden interactions between elements of practice, present challenges when efforts are made to try to capture or clarify complexity within the system.

While authors will describe tensions with the use of competency frameworks – and by extension, their development – their arguments have largely focused on the problematic nature of reducing a profession to its parts [26,27]. Few have considered or at least been explicit about how to resolve the role of complexity, unpredictable practice issues and interactions trainees or professions have

with larger healthcare environments or systems. For example, Sweeney has criticized approaches to competency framework development as overly reductionist, as a series of elements that risks de-contextualizing practice and denying the importance of the connectedness of these elements [26]. Bradley further criticizes the ‘siloeed skill set’ nature of professional competency frameworks, which fails to capture the complex, multidisciplinary nature of professional practice [28]. Though not speaking directly to competency framework development, Plsek and Greenhalgh further this argument by illustrating that a linear, reductionist approach to practice - which assumes all processes can be broken down into constituent units - fails when no part of the equation is constant, independent or predictable [29]. Therefore, to reduce the risk of uncertain outcomes when describing practice, there may be a benefit in shifting the focus from proof of completion of “competencies” to understanding how healthcare professionals perform their daily work, and from simplifying to embracing complexity to promote a better understanding of the people, elements, and contexts involved in the real-world enactment of clinical practice [30].

Shifts toward the embracing of complexity in medical education have demonstrated value. For example, in program evaluation, a growing number of researchers have acknowledged the complex environments in which “programs” are enacted, appreciating the messy and unpredictable nature of real-world processes [31–34]. There is a recognition of how simply reducing programs and their evaluation to methods focused largely on outcomes may be inadequate to generate meaningful understanding of processes, contexts, and how and why programs thrive. As a result, researchers have emphasized the need to acknowledge context, to capture processes, and to report on the messiness in which programs exist [35–37]. In program evaluation, approaches have included systems approaches [38,39], contribution analysis [32], program-theory based evaluation [37], and the role of conceptual and theoretical frameworks to guide their work [34]. For example, Rojas et al. developed a program evaluation framework informed by systems engineering (closely related to systems thinking) [31]. This framework provides those evaluating programs with the ability to evaluate intended, enacted and absent program elements (processes and outcomes). The ability to capture and evaluate emergent (i.e. unplanned) elements embraces the unique characteristics of every program implementation and provides evaluators with additional perspectives when evaluating a program. This has provided researchers with the means of evaluating programs in ways that make better use of the relationships between interventions, processes, and outcomes in program design and delivery.

Another area of healthcare that has embraced the complex interactions between people, processes and outcomes is quality improvement. It is generally accepted that the systems we work within are at the root of many patient safety and healthcare quality problems [40,41]. Systems-based practice is an awareness of and responsiveness to the larger context and system of health care and is considered a core competency for high quality, safe patient care [42]. In this case, systems thinking is the foundational construct of systems-based practice [43]. Johnson et al., Volbrecht, and Carey illustrate that systems-based practice (e.g., approaching practice with a systems thinking perspective) as part of diverse quality improvement initiatives resulted in improved patient care and outcomes in geriatric emergency medicine [44] (e.g. reduction in revisits), vascular surgery [45] (e.g. reduction in length of stay), and neonatal intensive care [46] (e.g. reduction in catheter-related bloodstream infection). Similarly, Englander demonstrated that when concepts of larger systems were part of the how practice was intended to take place, this generated solutions shaping reductions in hospital costs, leading to more economical healthcare delivery [47]. Systems-based

practice can also enable us to identify influences on patient outcomes – the importance of healthcare professional wellbeing, for example, resulted in Bodenheimer’s proposal to alter the original Triple Aim for Healthcare (IHI) into the Quadruple Aim [12]. However, even systems-based practice has been criticized for being too healthcare system-centric, while largely ignoring social and structural determinants of health [9] – thus an opportunity remains to identify means by which to represent these influences on health.

These shifts in program evaluation and quality improvement represent efforts towards a holistic understanding of elements in context in ways we have yet to observe in competency framework development. Therefore, we suggest that similar ‘systems thinking’ approaches that identify and make use of the role and influence of system features and contexts can provide value when developing competency frameworks in health professions education. Such approaches can provide those developing competency frameworks with a means by which to better represent practice. In addition, systems thinking approaches provide flexibility when identifying current and future practice needs, and as a result, can provide meaningful insight when developing competency frameworks or downstream activities such as curriculum design.

Overview of a systems approach to competency framework development

Systems thinking

Considering the ‘system’ provides new ways of “seeing” competency framework development. General Systems Theory is a macro-theoretical framework which suggests that systems share universal organizing principles [48]. There are many definitions of system, but broadly speaking, a system can be described as an organized assembly of components that share a special relationship. Each system represents a whole with boundaries that delineate it from other systems, yet allows them to interact [49,50]. Components within systems can include people, elements (e.g. policies, equipment, curricula), the roles of people, their needs, concerns, obstacles, conflicts, targets, processes, and more [51]. We elected to frame our work by adapting Bronfenbrenner’s Ecological Systems Theory [EST], which we will explore in further detail shortly, as it offers a realist perspective of the “person, of the environment, and especially of the evolving interaction between the two” [52]. EST furthers von Bertalanffy’s theory by attempting to capture the complex dynamics within social systems. Outcomes cannot be explained simply by the components of a system; the relationships between components and their environment must also be considered [26,49,53,54]. This perspective brings a second and related feature of “systems thinking”, that is the role of complexity. Complexity thinking obligates attention to a large number of heterogeneous elements which are influenced by and in turn influence other elements within a system. These features, along with many diverse agents, working autonomously yet connected, combine to make a system complex but meaningful [26,49,53,54]. It is these ways of “seeing” – the application of “systems thinking” - that sheds light on relevant relationships or interactions that have status in shaping what professions must account for in ‘real world’, messy contexts [36,55,56]. This may allow us to improve the competency framework development processes in novel ways. Next, we examine EST and what it may offer, including its limitations, followed by a focus on applied complexity thinking in healthcare.

Ecological Systems Theory

Originally conceived as a theoretical perspective for research in human development, Bronfenbrenner describes EST using the analogy of “a set of nested structures, each inside the next, like a set of Russian dolls” [52, p3]. It comprises the person situated within four interrelated environmental systems, namely, the (1) micro-, (2) meso-, (3) exo-, and (4) macro-systems, and obligates a focus on the person, processes, context, and time. EST stresses person-context interrelatedness, and the levels describe settings in which people directly interact (micro- and meso-systems) to larger settings that indirectly influence people (exo- and macro-systems) [52,57]. All levels of the system are enacted within the chronosystem, which are changes that occur within the system over time [52]. Bronfenbrenner illustrates his theory with the example of a child learning to read. The reading ability of a child is heavily influenced by a multitude of factors at various system levels: at the person level (e.g. home or school setting, how the child is taught); the relationship between settings (e.g. the links between home and school); broader settings where the child is not present (e.g. the employment status of the child’s parents); societal influences (e.g. culture); and the impacts of global events (e.g. economic crises that impact parental employment). This example illustrates how EST is a suitable framework to explore the influences on human development in settings such as social care [50].

When EST is applied to healthcare, the person level reflects a “patient-centred” system. Clinical microsystems are embedded in larger systems and are by their definition “patient-centred” [58]. Patients’ health status is influenced by a multitude of social, economic, cultural, and other factors. The microsystem refers to the immediate clinical practice environment, and all components within it (including people, their characteristics, places etc.). Next, the mesosystem represents the interactions that occur between people and the enactment of policies and procedures [59]. The exosystem refers to the community level or the service delivery level (e.g. hospitals, clinics, healthcare services). While healthcare services exist at the exosystem level, the delivery of such services takes place via the mesosystem through the complex interactions between people and policies. National or local level influences such as government policies, culture, religious movements, the economy, and societal issues are examples of macro-system level forces. Broader influences such as global events (e.g. pandemics), and sociopolitical issues such as war, and mass immigration exist at the supra-macro level. Finally, the chronosystem refers to the changes over time, which can occur at all levels of the system. See Figure 1 for an illustration of EST applied to healthcare.

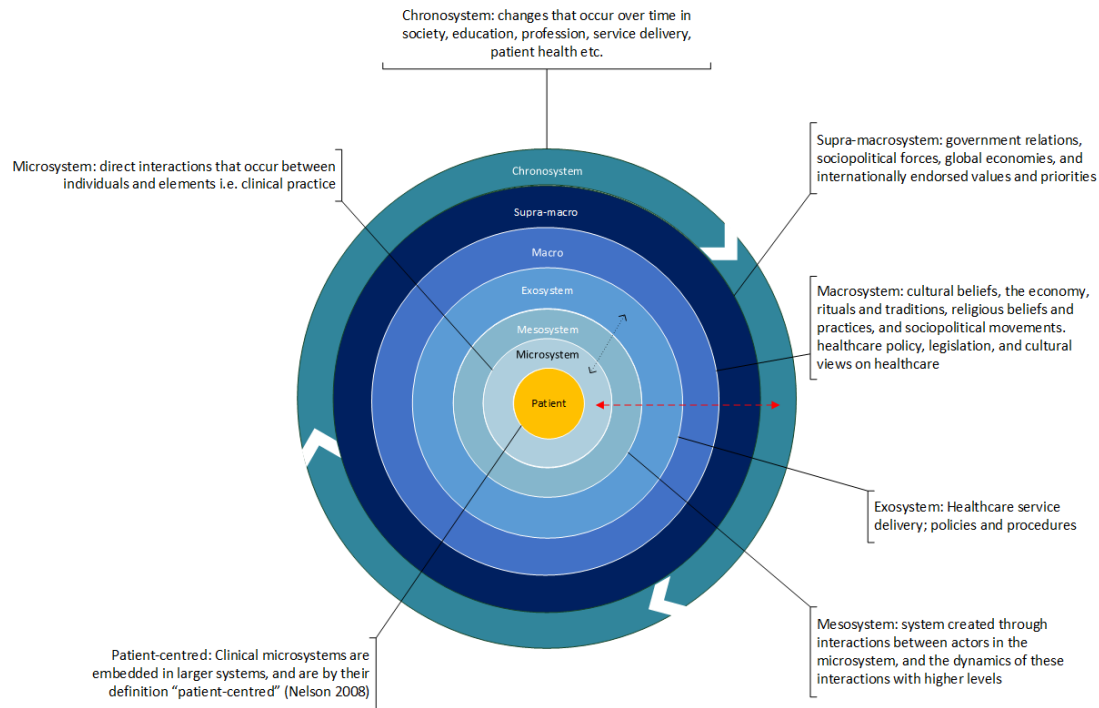


Figure 1. Ecological Systems Theory (EST) applied to healthcare.

The black arrow represents the creation of the mesosystem level through the interactions between people, policies etc. in the microsystem and exosystem. The grey arrow illustrates the ability of any given level to influence any other level. Labels briefly describe each system-level applied to healthcare.

EST facilitates a focus on the features of various healthcare system levels to better inform dependent outcomes (e.g. policy, program design). Previously, researchers in healthcare have used elements of EST to identify the features of the healthcare system in which individuals directly interact (e.g. clinical practice) to larger settings that indirectly influence patient care (e.g. hospitals, healthcare policy) [50,59,60]. For example, Dobbs used EST as a framework to identify which level of system changes needed to be made to improve end-of-life care (EoLC) [60]. They identified changes at multiple system levels, in particular the need to refocus aspects of EoLC to be more person- and carer-centred. In a second example, Pask et al. used EST to explore the complexity of palliative care [59]. Their research uncovered issues such as the complexity surrounding dissonance between healthcare professionals and families, individual patient needs and characteristics, and the need for multidisciplinary team approaches to care. When applied to healthcare, EST would suggest that patient care, which is enacted in the microsystem of clinical practice, cannot be viewed in isolation but must be considered as a person-focused process that occurs in the context of broader environments that change over time. As such, using EST presents an opportunity to conceptualize the influences on patient care, and the contexts that shape practice to identify the agents, elements, and other components that should be considered when attempting to represent clinical practice when developing competency frameworks.

Complexity thinking

While EST may allow us to conceptualize the persons, processes and contexts in which clinical practice occurs, it faces a challenge when we attempt to explore how we enact practice in the messy real-world, where multiple complex, unique, and context-embedded problems exist, few of which could be described as simple [29,53,61–63]. How the features of each level of a system interact creates unique problems that can be so messy and unwieldy that they defy traditional analysis approaches, and may refuse definitive resolution [64,65]. Instead, they require a shift towards acknowledging and embracing complexity, and its underlying logic [66].

Waiting times in Emergency Departments (ED) provides an example of a complex, non-linear system that can produce unexpected outcomes [26,67]. For instance, researchers have described multiple, interwoven issues including hospital bed capacity, discharge delays, neo-liberal policies which reduce funding and staffing levels, and seasonal patterns combining to produce the unintended outcome (i.e. prolonged waiting times) [26,68–71]. Rarely can we identify a linear causal relationship or single source of such wait times. Further examples of complexity exist when we consider case-mix, the unpredictable progress of the disease, practice variations between professionals, and the concept of adaptive expertise [26,29,72] in various contexts such as primary care [49,73–75], nursing [76], and palliative care [59]. It is only when “problems” are viewed through these “complexity” lenses – particularly when applied to EST – that we can find new ways of seeing, and follow new paths to solutions.

To illustrate this point, we revisit each level of the system outlined earlier and suggest a source of complexity evident at each level. Patients themselves, their disease progression, and the influencing factors on their health are complex systems [49,59,73]. In the microsystem of clinical practice, the tacit knowledge of professional practice, and the unpredictable nature of clinical practice present challenges when we attempt to describe them. At the mesosystem level, interactions between large numbers of heterogeneous agents, the dynamics of these interactions, and the influences on such interactions are numerous. Healthcare system dynamics in the exosystem (i.e. how services are delivered, by which agencies, and how various policies may complement or conflict) can be complex and subject to regular change. The overlapping functions of regulation and education of health professionals at regional or national levels represent an additional source of complexity. On a global scale, the impact of forces such as war, oil prices, weather and natural disasters, and (as we are now experiencing) pandemics can be unpredictable, expansive, and dynamic. As such, when we fail to acknowledge and capture the complex contexts in which healthcare delivery is enacted, we fail to accurately represent clinical practice, and we fail to adapt to future challenges.

At least three implications are derived when such complexity is considered along with EST when developing competency frameworks. First, complexity thinking illustrates how systems are not as linear and predictable as EST may suggest. To fully understand a system and sufficiently describe it, the relationships, interactions, and dependencies at and between levels may need to be explored. Second, neither EST nor complexity thinking alone may be sufficient to conceptualize clinical practice [59,77]; EST may struggle to illustrate real-world relationships, while complexity thinking risks being too abstract to be practical. Third, combining both as a form of systems thinking may help us to examine how clinical practice is shaped, or at least better understood, by the way,

contexts and relationships are connected [59]. The application of a systems thinking conceptual framework (i.e., EST combined with complexity thinking) provides us with the ability to see the broader influences on patient care, and therefore relevant outcomes that may otherwise remain hidden. Figure 2 provides a conceptual linking of the levels of EST and their relationships and dependencies.

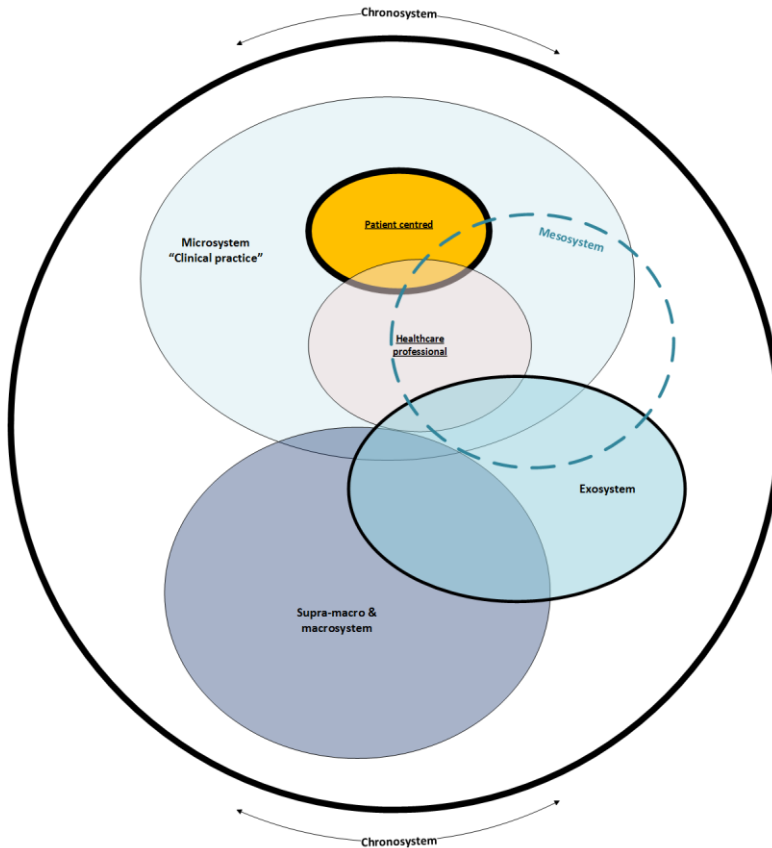


Figure 2. Systems map of healthcare contexts.

The linear system levels identified via EST in Figure 1 have been transposed into a systems map, designed to illustrate the relationships or interactions between the system levels in a 'real world', non-linear sense. Note: (a) size of elements is irrelevant; (b) overlaps do not illustrate significance but rather illustrate influence; (c) model is a partial representation of healthcare systems (as are all models).

Applying the framework

As an example of how systems thinking may present new ways of seeing, we now apply the approach to two healthcare professions competency frameworks; emergency medicine and paramedicine. The existing competency frameworks do not explicitly mention which, if any, theoretical or conceptual frameworks guided their development [78,79]. However, it is possible that the authors did consider at least some of these issues during the creation of these competency

frameworks. Our goal is to illustrate how considering the broader healthcare system and its complexity may offer us new insights into the competencies required of healthcare professionals. First, we will consider the Royal College of Physicians and Surgeons of Canada's Emergency Medicine (EM) Entrustable Professional Activities (EPAs) [78]. This outlines several key skills and knowledge areas of EM physicians. While the complexity of individual patient presentations is acknowledged throughout, the application of a systems thinking approach presents some additional activities that could be considered. Working our way out from patient-centred care, these might include managing patients in a culturally appropriate manner, (e.g. BIPOC); at the microsystem level recognizing the broader role of psychosocial and socioeconomic aspects of patient presentations (i.e. structural competency - the document focuses on those who frequently attend the ED); developing a healthy lifestyle in response to the demands of EM work (the focus is on coping strategies); within the mesosystem, receiving feedback from other healthcare professionals (the focus is largely on providing feedback); at the exosystem level, providing resource-limited care or extended care determined by the context of practice (e.g. remote and rural Canada); planning for and adapting to changes in service demand and case presentations based on external macro- and supra-macro influences (e.g. pandemics, climate change, mass immigration); preparing for changing practice due to climate change; and using evolving technology such as artificial intelligence systems.

Second, the National Occupational Competency Profile (NOCP) for Paramedics in Canada [79] provides another example where elaborations become evident when viewed with a systems thinking conceptual framework. Again, working our way out from patient-centered care might include the consideration of providing culturally competent and safe care (e.g. to Indigenous persons); creating reflective professionals; at the microsystem level, identifying competencies (and therefore informing curriculum design) that accurately reflect clinical caseload and call characteristics (e.g. increasing elderly population, a large proportion of non-emergency workload); recognizing the psychosocial and socioeconomic influences on patient presentations (i.e., structural competency); supporting families with grief and bereavement (in both sudden and expected deaths); at the mesosystem level, leading and working effectively within ad-hoc teams (a common occurrence for paramedics); at the exosystem level, acknowledging the diversity of paramedic practice contexts within and between provinces; and at broader macro and supramacro levels, preparing for the impacts of climate-change on practice; and identifying the role requirements of paramedics in non-traditional practice settings (e.g. ED, organ/tissue donation programs, palliative care programs).

The application of our systems thinking conceptual framework to both the EM and Paramedic frameworks is not to suggest these competency frameworks were developed inappropriately; rather, it is to suggest that some areas of professional practice may remain tacit and hidden until we employ new ways of exploring and seeing [66]. Using a systems thinking approach embraces the challenge of representing complex problems well. Doing so may allow medical educators to provide healthcare professionals with the ability to understand and respond to the contexts of the healthcare system to improve patient care [42].

Considerations and conclusion

One of the claims our proposed conceptual framework may be vulnerable to is that no single correct outcome exists for a complex problem; much depends on the specific contexts and relationships. Recognizing that ‘a way of seeing is also a way of not seeing’ [81 p49], we acknowledge that there may be other approaches that provide insights neglected by our proposed systems thinking conceptual framework. Just as no universal solution exists to a complex problem, there is no single ‘correct’ approach to describing clinical practice or the required competencies to enact it. However, we suggest that the utility of a systems thinking approach lies in its ability to highlight broader structural features of a system that have historically been overlooked when developing competency frameworks. Professional practice is more than “doing the work”. Another critique could be leveled against systems thinking in general. Some may argue that systems thinking is too broad, overwhelming and generalist to be useful. We offer that our systems thinking conceptual framework is merely another tool for medical educators to use. A competency-based approach presents medical educators with challenges in terms of how best to develop, teach and assess competencies [20]. The conceptual framework can aid with developing competency frameworks by providing a means to test systems thinking across professional practice contexts. Doing so may help developers to gain a better understanding of the system they are attempting to represent. While we must appreciate that we may never fully capture the complex world of clinical practice, systems thinking can help us to expose components and relationships that further our understanding of clinical practice [66].

We suggest that efforts to describe clinical practice for competency framework development may be improved by intentionally “seeing” and attending to healthcare features (influences and relationships) that are made visible when viewed through a system thinking conceptual framework. Our ability to describe clinical practice may be improved when we outline what features may be relevant and their potential interactions, and how we can go about understanding these. A conceptual framework informed by systems thinking illustrates how important features may previously have been overlooked, and how our previous attempts to describe clinical practice may therefore not be aligned with the realities of practice. Adapting Ecological Systems Theory to a healthcare focus provides us with the means to identify and describe the persons, processes, and contexts of the healthcare system from direct patient-care to global influences. Complexity thinking complements this perspective by obligating us to focus on the non-linear relationships and dynamics between people, policies, and processes across all levels of the healthcare system. In applying this conceptual framework, we may be able to improve our understanding of clinical practice when developing competency frameworks.

Declarations of interest

The authors declare no conflicts of interest.

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