Six steps in the right direction: guiding the development of competency frameworks in healthcare professions.

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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.

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Abstract
The development of competency frameworks in healthcare professions is characterised by potentially inadequate descriptions of practice, variable developmental approaches, and inconsistent reporting and evaluating of outcomes. This may be in part due to limited existing guidance, which neglects broader contexts, lacks organising frameworks, and fails to provide guidance on selection of methods. To address such concerns, this paper first outlines a 'systems thinking' conceptual framework by which to conceptualise and describe clinical practice when developing competency frameworks. This is achieved through combining Ecological Systems Theory and complexity thinking to identify, and explore the contexts and components of clinical practice. The 'systems thinking' conceptual framework is then integrated into a six-step model for developing competency frameworks that synthesises and organises existing advice. The six steps include (1) identify practicalities (e.g. purpose, scope, detail, timeline), (2) identify influencing contexts and factors using 'systems thinking', (3) use aligned mixed-methods, (4) translate data into competency frameworks, (5) report processes and outcomes, and (6) plan to evaluate, update and maintain the competency framework. The model provides a logical organising structure of principles to guide assumptions and commitments when developing competency frameworks. Additionally, the model affords the flexibility required when exploring professional practice across varying contexts, and suggests employing mixed methodological approaches that are aligned with purpose and scope. The model acknowledges changing and complex contexts, considers existing guidance, and adds a unique and complementary means to conceptualise and improve the competency framework development process.

Introduction
Healthcare professionals have developed competency frameworks that aim to outline the key knowledge, skills, attitudes and other attributes required for competent professional practice. In order to better prepare healthcare professionals to acquire the competencies required to enact clinical practice, competency-based medical education (CBME) has gained popularity as a means to standardize education [1]. While competency frameworks inform CBME approaches, challenges exist. For instance, there is little evidence regarding whether competency frameworks reflect the purpose they intend to serve, or whether the outcomes reflect the competencies needed in practice. Further, some have argued that competency frameworks are reductionist in nature, siloing professionals' skill sets in a way that does not represent complex clinical practice [2]. These challenges may exist because of a lack of helpful organizing or conceptual frameworks guiding the development of competency frameworks. In a previous scoping review [3], we identified that framework developers made limited connections between the intended use of the competency framework and development choices, inconsistently adhered to existing guidance, and inadequately reported processes and outcomes. This elevates the risk of inaccurately or illegitimately representing practice, which in turn can have significant downstream effects on policy, regulation, curriculum, and assessment frameworks. Given the stakes that such competency frameworks hold for aspects of professional practice, there is a need for improved guidance when developing and reporting competency frameworks, particularly related to improving the suitability, utility and validity of outcomes.

Limited guidelines exist for those who develop competency frameworks, particularly related to how the intended competency framework is situated in, or influenced by, contextual features

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during the process of developing or evaluating such outcomes. Medical educators today appreciate the multiple complex and interrelated issues involved in healthcare delivery, which evolve due to changes in society, technology, culture, and organizations. Furthermore, we understand that clinical practice varies according to the attributes of the individuals and teams who enact it, and is influenced by variability in patients, regions, and contexts. As such, competency frameworks need to reflect the healthcare system they exist within [4]. Doing so requires us to include how multiple issues in healthcare and clinical practice are connected [5]. This includes the need to ensure healthcare professionals can perform in uncertain and unpredictable situations [6]. To reduce the risk of uncertain outcomes in competency frameworks, we must shift our focus from proof to understanding, and from simplicity to complexity to help us to better understand the people, components, and contexts involved in practice [7]. However, existing guidance appears vague in how to organize the reflection and inclusion of 'real world' complexities, thus neglecting core concepts and subsequently threatening validity claims [3]. As a way forward we propose broadening the use of conceptual frameworks to improve our understanding of practice and those who enact it. Next, we describe a proposed conceptual framework intended to provide an improved understanding of clinical practice, and we will then outline how to integrate this conceptual framework into an improved competency framework development model.

Improving Competency Framework Development: A 'Systems Thinking' Approach To Understanding Clinical Practice.

Focusing on the complex, often unpredictable nature of 'real world' clinical practice and the contexts in which it is enacted can present opportunities when attempting to describe or define it for competency frameworks. Previous guidance acknowledges context; however, it is confined to analysis of the profession (e.g. job or role analysis), and guidelines lack conceptual frameworks to guide the work [8,9]. Elsewhere in medical education, such as program evaluation for example, research has prioritized a focus on 'real world' contexts [10–13]. While outcome-based approaches traditionally dominated this field, a growing number of authors now acknowledge the complex environments in which programs are enacted, appreciate the messy and unpredictable nature of 'real world' processes , and consider existing reductionist methods (focused largely on outcomes) inadequate to generate meaningful understanding of processes and contexts [10–13]. As a result, researchers have proposed novel approaches to acknowledge context, to capture 'real world' processes, and to report on the messiness in which programs exist [14–16]. These include systems approaches [17,18], contribution analysis [11], program-theory based evaluation [16], and the role of conceptual and theoretical frameworks to guide their work [13]. This shift to a holistic understanding of elements in context means that future efforts at evaluating programs may better understand the relationships between interventions, processes, and outcomes toward improving program design and delivery. We propose that identifying and appreciating the role and influence of contextual features of the system can also benefit guidelines that inform the development of competency frameworks.

General Systems Theory is a macro-theoretical framework which suggests that systems share universal organizing principles [19]. A system is *"an organised assembly of components that share a special relationship with each other"*, whereby each system is a whole, with a boundary which delineates it from other systems, yet allows them to interact [5,20]. Components within systems can comprise agents, elements, roles, needs, obstacles, conflicts, targets, processes, concerns and more [21]. One approach to systems theory is Bronfenbrenner's Ecological Systems Theory (EST), which

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offers a realist perspective of the "*person, of the environment, and especially of the evolving interaction between the two*" [22], and obligates a focus on the person, processes, context, and time. While their interactions are less clear when focusing on systems alone, models of complexity can help. Outcomes cannot be explained simply by the components of a system; the relationships between components and their environment must also be considered [5,19,23–25]. Complexity thinking further outlines that a large number of heterogeneous elements, which are influenced by, and in turn impact other elements, along with many diverse agents working autonomously yet connected, combine to make a system complex [5,19,23–25]. Both EST and complexity thinking are forms of 'systems thinking'. Therefore, we propose that using a systems thinking approach which combines EST with an aggregate complexity perspective that obligates a focus on relationships in 'real world', messy contexts [26,27], affords us the means by which to explore the contexts, components, and relationships in a system [15,26]. Next, we examine EST and what it may offer, including its limitations, followed by a complementary perspective using applied complexity thinking in healthcare when developing competency frameworks in healthcare professions.

Ecological Systems Theory

Originally conceived as a theoretical perspective for research in human development, Bronfenbrenner describes EST as *"a set of nested structures, each inside the next, like a set of Russian dolls"* [22]. It comprises the person situated within four interrelated environmental systems, namely, the (1) micro-, (2) meso-, (3) exo-, and (4) macro-systems. All levels of the system are enacted within the chronosystem, which are changes that occur within the system over time [22]. Ecological Systems Theory 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) [22,28]. See Figure 1 (a) for an illustration of the EST framework applied to healthcare.

Previous applications 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) [20,29,30]. For example, Dobbs used EST to identify which level of system changes needed to be made in order to improve end-of-life care [29]. EST facilitates a focus on the features of various healthcare system levels to better inform dependent outcomes (e.g. policy, program design). When applied to healthcare, EST states 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 in which practice is enacted in order to identify the agents, elements, and other components which should be considered when developing a competency framework. The table in Supplementary Digital Appendix I outlines the various system levels, provides a definition for each level, and suggests a principal cause of complexity at each.

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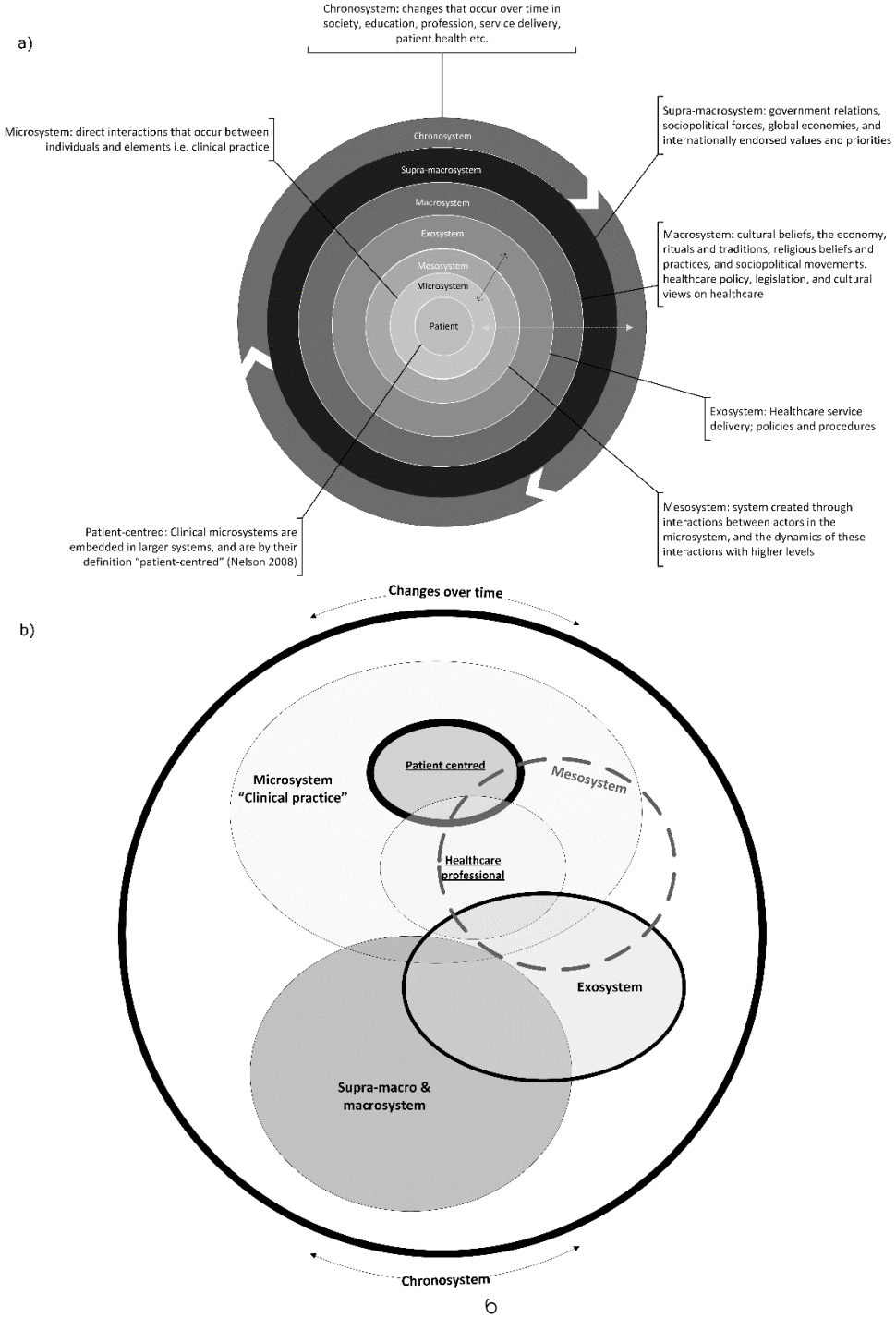
Figure 1.

a) Ecological Systems Theory (EST) applied to healthcare. The dark arrow represents the creation of the mesosystem level through the interactions between agents in the microsystem and exosystem. The light arrow illustrates the ability of any given level to influence any other level. Labels briefly describe each system level applied to healthcare.

b) 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).



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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 [23,31–34]. The way in which features of each level of a system can interact creates unique and complex problems that can be so messy and unwieldy that they defy traditional analysis approaches, and refuse definitive resolution [35,36]. Instead, they require a shift towards acknowledging and embracing complexity, and its underlying logic [6]. Waiting times in Emergency Departments (ED) provides an example of a complex, non-linear system that can produce unexpected outcomes [24,37]. 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) [24,38–41]. Rarely can we identify a linear causal relationship or single source of such wait times. Other examples of complexity exist in primary care [5,42–44], nursing [45], and palliative care [30]. Further examples of the role of complexity exist when we consider case-mix, the unpredictable progress of disease, and practice variations between professionals [24,33].

At least three implications are derived when complexity is considered along with EST for competency framework development. 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 offer a novel perspective by which to conceptualise clinical practice [30,46]; EST struggles 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 by, or at least better understood, when contexts and relationships are considered [30]. Figure 1 (b) provides a conceptual linking of the levels of EST and their relationships and dependencies, as informed by complexity thinking. Next we apply these concepts to one healthcare profession as an example, to illustrate their potential enactment.

Systems thinking to improve understanding of clinical practice

In the example that follows, we illustrate what might be included for paramedicine using systems thinking (i.e. blending of EST and complexity thinking) in order to conceptualise the contexts and complexity of clinical practice, toward developing competency frameworks. Paramedics are professionals who provide patient-centred urgent, emergency, immediate, episodic, and unscheduled health care to individuals and families in the community [47]. A relatively new healthcare profession, paramedics in many jurisdictions are experiencing change and evolution [48], yet share many common characteristics. For these reasons, we suggest paramedicine provides a suitable and transferable exemplar of this approach for us to model. The EST part of our systems thinking approach helps to explore and identify the system of paramedic practice, and might lead to the components we include in Figure 2. See table in Appendix 1 – Exploring the system for additional detail. Once identified, sensitized by perspectives of applied complexity in healthcare (the second part of our systems thinking approach, as described above), relationships between system levels, and components, in 'real world', non-linear contexts can be explored. To visually represent this process we transposed the identified system levels and components from our

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'paramedic practice' EST model, and identified their relationships to each other (see Figure 3). We describe paramedic practice at each system level in a table in Appendix 1 – Exploring the system. This along with Figures 2 and 3 are only hypothetical examples to illustrate concepts not typically included, but relevant, to competency framework development guidelines. We will next describe how to use this 'systems thinking' conceptual framework when developing competency frameworks in healthcare professions.

Figure 2. The system of paramedic practice informed by EST. The dark arrow represents the creation of the mesosystem level through the interactions between agents in the microsystem and exosystem. The light arrow illustrates the ability of any given level to influence any other level. Labels briefly describe each system level applied to paramedicine.

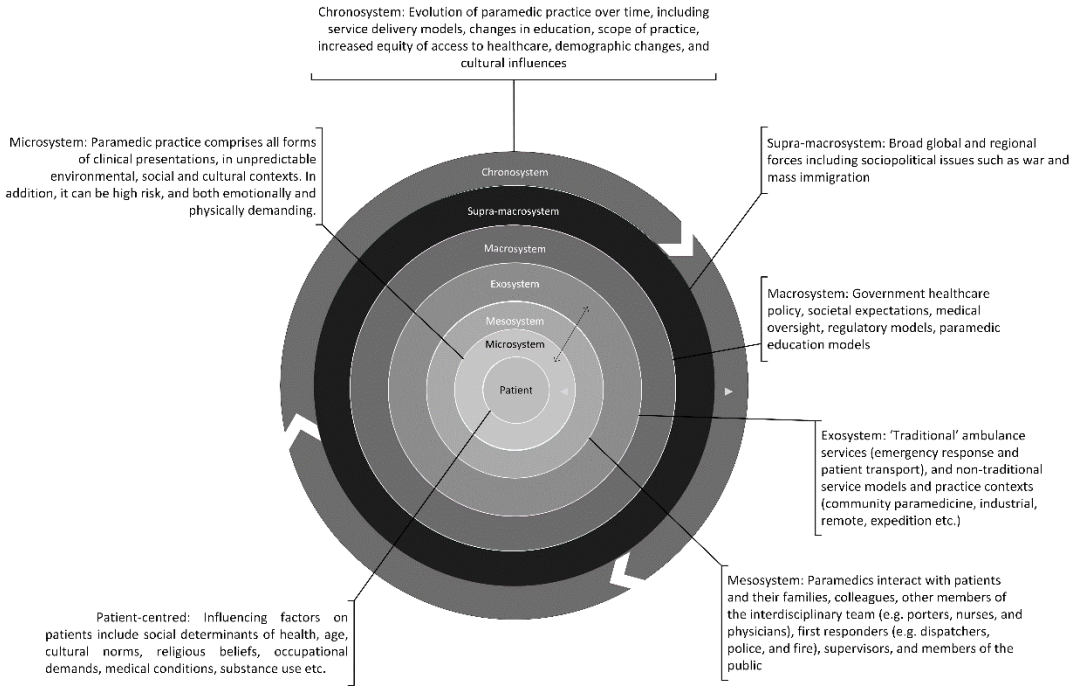

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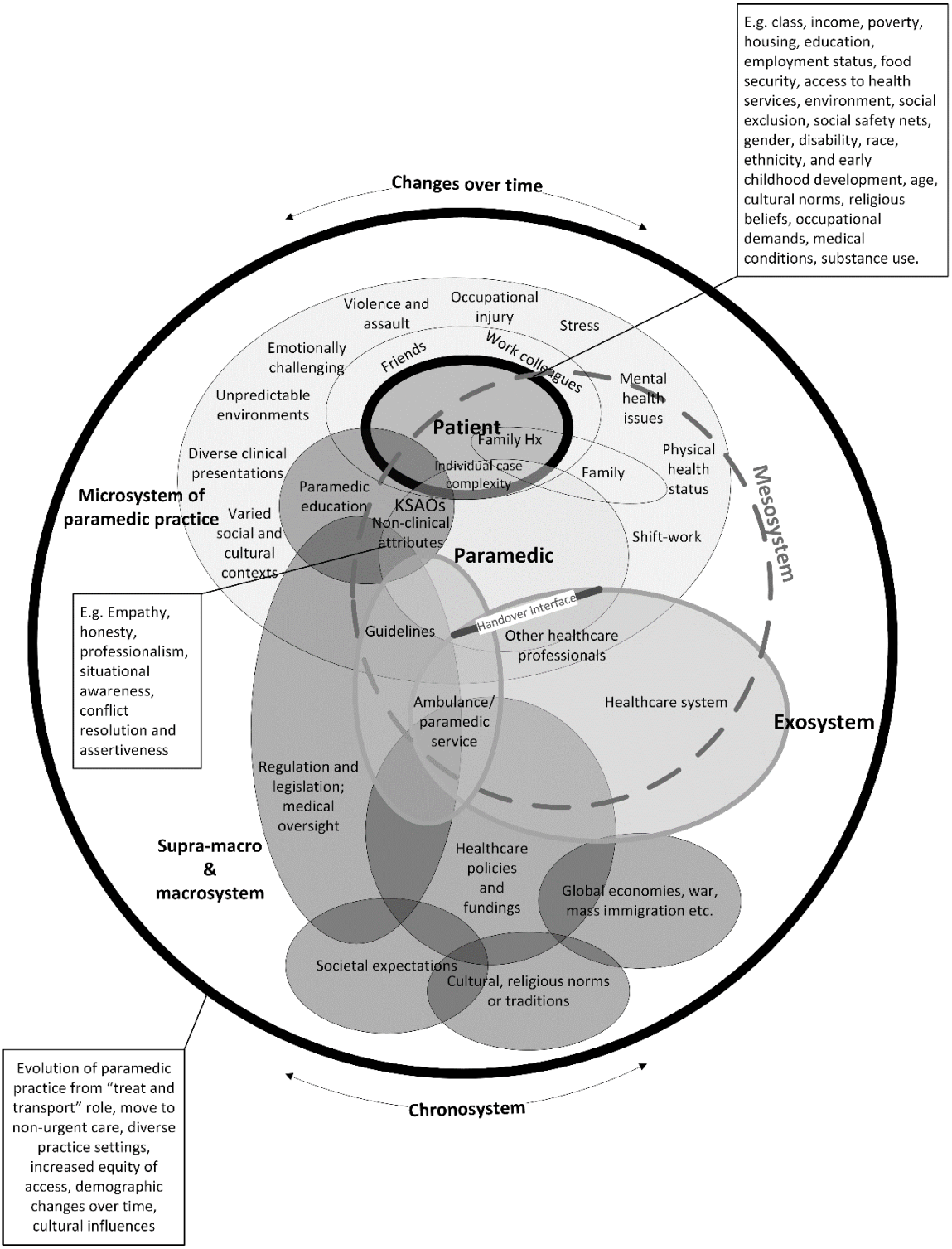
Figure 3. The 'real world' interactions of paramedic practice, informed by EST and complexity thinking, and illustrated via a systems map. Note: (a) size of elements is irrelevant; (b) overlaps do not illustrate significance but rather illustrate influence; (c) Note: (a) size of elements is irrelevant; (b) overlaps do not illustrate significance but rather illustrate influence; (c) model is a partial representation of the system of paramedic practice. KSAOs = knowledge, skills, attitudes and other attributes (i.e. competencies).



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Improving Competency Framework Development: A Six-Step Model

Existing guidelines related to developing competency frameworks lack organising frameworks and omit a number of core concepts that may subsequently threaten validity claims [3]. In a previous scoping review, we outlined that existing guidance related to developing competency frameworks appears disjointed, is vague on how to reflect and include 'real world' contexts and complexities, and lacks detail on methodological choices [3]. Perhaps as a result, developers often neglected to outline purpose, sequence, or rationale for their methodological choices, how data were prioritized, triangulated or integrated, and other conventions found in mixed-methods research practices [49]. Much of the detail related to the development process remained implicit or was inconsistently reported by developers, which again threatens validity claims, may inappropriately or unreliably represent practice, and presents an obstacle when professions attempt to use or adopt competency frameworks. Finally, despite existing guidelines which highlight the need to evaluate and update competency frameworks, a minority of studies reported, recommended, or planned to evaluate the competency framework [3].

As a way forward we propose that future guidelines may benefit from synthesis and organizing of existing guidelines, and means to consider the contexts and components of the system of practice. This may include: (1) improved guidance related to identifying purpose, scope, and detail which will need to be considered within available timeline, resources etc. (i.e. practicalities); (2) novel ways of identifying the people, elements, and contexts of complex, 'real world' clinical practice (we propose systems thinking, informed by EST and complexity perspectives); (3) aligned, fit for purpose mixed-methods, and means to generate data by which practice features and contexts can be explored; (4) advice on translating data into the competencies required for professional practice; (5) reporting the processes and outcomes of identifying competencies that are aligned with intended purpose, scope and detail; and (6) including strategies or plans to evaluate, update and maintain competency frameworks. We therefore propose a six-step competency framework development model that addresses the outlined concerns, synthesizes existing guidance, and incorporates the 'systems thinking' conceptual framework (as described above). We illustrate this six-step model in Figure 4, and outline in detail the steps, considerations, and principles of implementing the model in Table 1. Our intended contributions to the healthcare professions competency framework development literature are: (a) to synthesize and then organize existing literature in a way that provides developers with principle-structured strategy (the six-step model); (b) to acknowledge real world contexts and complexities using 'systems thinking' (Step 2); and (c) to promote the use of 'fit-for-purpose' mixed-methods (Step 3).

Figure 4. The six-step competency framework development model. Note: dashed lines indicate considerations and dependencies. The arrows suggest a logical sequence when developing a competency framework, and are not indicative of a rigid sequence of steps that cannot be deviated from.

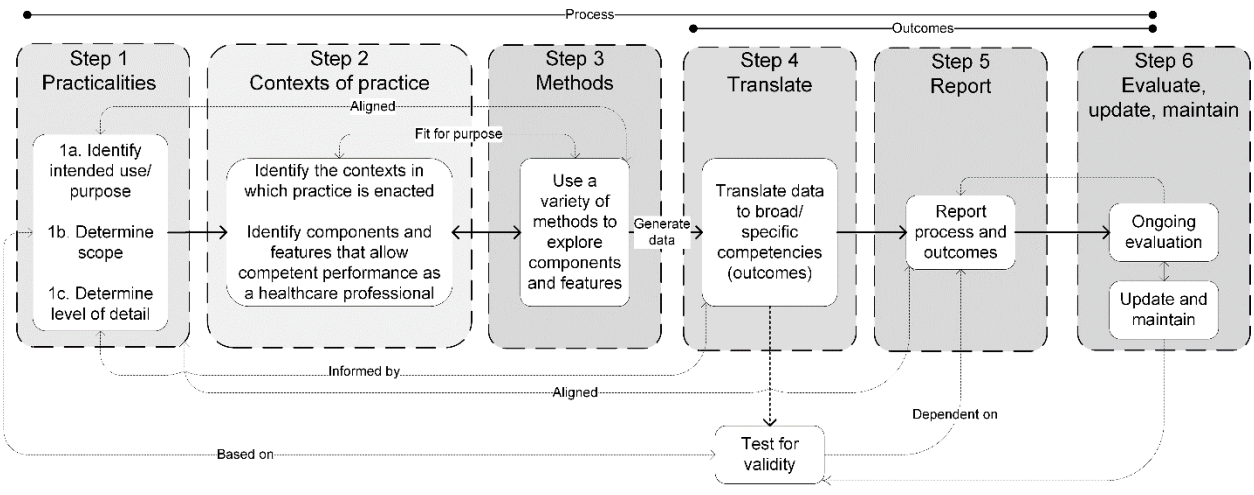

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Table 1. The six-step competency framework development model

Step	Consideration	Definition	Guiding principles
1	Practicalities	Consider in advance the practicalities (such as purpose, scope, detail, timeframe, resources, budget, expertise etc.) when planning to develop a competency framework.	• Developers' decisions regarding purpose, scope and detail may need to consider resources, such as timeframes, experience and expertise, maturity of the profession, mandate of the developer, consistency of roles within the profession, and the complexity of practice [3].
1a	Intended use/purpose	Identify the intended use or purpose of the framework in order to inform the strength of the validity argument that is required.	• Clearly outline the purpose and objectives of the framework – this serves to articulate specific claims of the framework, but also to determine if the final outcome sufficiently addresses those claims [8,50,51]. • Consider whether the framework is to be used to make a binary versus continuum argument (e.g. competent/not-competent versus learning; accreditation) [52]. • Intended uses with significant implications (e.g., for decisions regarding entry to practice, changing policy) obligates more rigour, information, sources and/or data in the developmental process [9,53,54]. • Consider who the key users/stakeholders are of the framework and their needs when establishing purpose [53,54].
1b	Scope of contexts	Identify the contexts and boundaries in which the framework is to be enacted.	• Consider how contextual the framework is intended to be, which will help to inform generalisability and adaptability of a framework beyond particular contextual boundaries. If developing a highly-contextual framework (e.g. for local education purposes), stating this begins to provide insights into what factors may need to be considered by those intending to use the framework [52]. • Scope may also be outlined as a set of underlying principles and philosophy that may allow for frameworks to be adapted for use in different contexts. • Many frameworks need to meet a wide range of possible applications (fundamental and technical); therefore consider who may benefit from its use and in what contexts [54,55].

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1c	Level of detail	Identify the level of detail required, balancing enhanced precision against competency in dynamic contexts.	• Consider in advance the level of granularity desired in the framework [55]. • Consider the balance between enhanced precision (atomistic) against competency in dynamic contexts (holistic) [52,55]. Atomistic frameworks risk introducing a reductionist, decontextualized approach to complex clinical practice, while holistic frameworks risk being too vague and generic and threaten utility [52].

2	Contexts of practice	Identify the contexts in which professional practice occurs when developing the competency framework.
		
		Identify components and features that allow competent performance as a healthcare professional.
			• Use 'systems thinking' to explore the relevant contexts and components of practice. This may involve an application of EST and complexity thinking as described above (see Figures 1 to 4 and Appendix 1 for detail).
			• Initial identification of contexts of practice is an iterative process that may be informed through searches of the literature, expert consultation, and authors own perspectives of the field. Consider identifying the contexts of practice as outlined by EST (see Figures 1 and 3, and Appendix 1):
			  ○ Patient-centred level
			  ○ Microsystem level
			  ○ Mesosystem level
			  ○ Exosystem level
			  ○ Macro and supra-macrosystem levels
			  ○ Chronosystem level
			• Exploration of the components of the system at the identified levels, and the complexity of relationships between agents and components (See Appendix 1) may be operationalized via a number of 'systems thinking' methods such as rich pictures and systems diagrams, including concept maps, influence diagrams (See Appendix 2), systems maps (See Figures 2 and 3), multiple-cause diagrams, human-activity system diagrams and others [21].
			• Developers should seek to analyse and describe the role and position of the profession as well as the attributes of individuals [8,9,56–58].
			• Involve those who will be affected by the framework (i.e. users) in its development. This may include involving patients, healthcare professionals, and stakeholders [51,53,54].
			• Reference existing guidance on systems thinking and complexity [21,24,59–61] etc.

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3	Methods	Use a variety of methods to explore the contexts of practice and describe components and features of practice and those who enact it.	• Inherent in the consideration of multiple sources of information is the need to consider the alignment of various methods/methodologies to obtain information/data related to those sources.
			• The choice of methods at each system level offers flexibility for developers (e.g. weighing practicality and cost-effectiveness, considering timeframes) [8,9,51,55] etc., but also opportunity to support or threaten alignment/coherence goals [49].
			• Mixing of methods (multiple methods) is necessary
			• Evidence to support the degree to which selected methods are "fit-for-purpose" should be considered with a rationale [62].
			• Selected methods should be applied defensibly, including but not limited to choice of sequence [62], and how data from multiple sources are integrated [62,63].
			• Developers may find value in referencing existing guidance on the design, conduct and reporting of mixed-methods research [49,64–68].
			• Professions should consider developing a representative steering group to lead the development of the competency framework [9].
			• Developers will select approaches based on their intended purpose, expected timeline, resource availability, experience, stakeholders, impact on and degree of intended/needed validity, etc. Consider exploring:
			  ○ Patient centred: Engage patient representatives; patient member of steering group; other forms of patient/public engagement or involvement etc.
			  ○ Microsystem: Engage and empower those who perform the job through appropriate means (e.g. interviews, focus groups, surveys); perform job or practice analysis [55,56] etc.
			  ○ Mesosystem: Engage other healthcare professionals (e.g. interviews, focus groups); engage and empower professional associations as stakeholders etc.
			  ○ Exosystem: Policy analysis; environmental scans etc.
			  ○ Macrosystem: Review national/regional health policies and accords; strategic analysis of national events, government policies etc.
			  ○ Supra-macrosystem: Review regional/international accords; identify and explore regional initiatives to collate health data etc.

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			○ Chronosystem: Literature reviews, review historical policy documents etc. See Appendix 3 - Suggested means to explore levels.
4	Translate	Translate the collected data into broad or specific competencies (outcomes), and validate the competency framework.	• The actual process of translating data to outcomes (i.e. competencies) will be informed and guided by methodological choices. • The blending of diverse sources of information/data is expected to require a level of interpretation by developers. • Consider what 'stake' to give each source of data. This raises considerations such as whether data sources are considered equal, the sequence of data use, the priority of sources, the merging of data, the timing of integration, and the process of analysis [63]. • Defensibility in the translation activity comes from philosophical alignment with methods and underlying principles, developing and implementing a plan of data collection and analysis that is methodologically defensible, and when methods that are fit for purpose are considered. • Competencies must be considered within the context of the profession, and linked back to intended purpose, scope and detail [55], once the professional role is broadly understood and defined (Steps 2 and 3) [9]. • Competencies should integrate the knowledge, skills, attitudes and other important attributes associated with an identifiable aspect of professional performance, and they should be expressed in terms of performance. • This includes expressing a competency in a manner that is easily understood, that is recognisable and demonstrable in professional practice, and is amenable to assessment [9]. • Informed by purpose, scope and detail, in addition to considering "what is", developers may also wish to consider "what will be needed in the future" and "what should be" when identifying competencies [53,55]. • Consider drafting an interim competency framework, and revise based on feedback from professionals, subject matter experts, and those who the framework will affect as part of this translational process [51,54,69]. • Once the competency framework has been finalised, it should be reported and communicated to the broader profession [54].

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5	Report	Report on the development process and the final outcomes.	• Developers should use the six-step model outlined here, including the guiding principles, to structure reporting of processes and outcomes. • Consider the use of diagrams, pictures, and heuristics to communicate competency frameworks to users [55].
6	Evaluate, update and maintain	Evaluate the competency framework at regular intervals. Update and maintain the competency framework as required based on evaluation, or changes over time.	• Competency framework development is a continuous process [8,9]; thus, the reported framework or its validity is never 'final' • As such, developers may wish to consider a 'living document' approach whereby the framework becomes a dynamic document that can be revisited and revised as time progresses, contexts change or practice expectations evolve. • Form and articulate a plan to evaluate, update, and maintain the competency framework over time [8,9,51,53,55,57,58]. • Competency frameworks may be treated as a type of 'program', and evaluated using existing program evaluation techniques [8]. Contemporary program evaluation models emphasize the complex interactions between program factors (i.e. how and why did it work?) [17]. • The use of rapid-cycle program evaluation approaches, although resource intense, may also provide developers with real-time evidence to support changes to processes and competency frameworks [70]. Consider applying similar approaches that acknowledge context, complexity and processes [10,11,15,18] to evaluate both the development process, the outcomes of the development process, and the enactment of a competency framework in practice [8]. • Frameworks require regular update and maintenance, more so if the profession is undergoing significant changes [55,71]. Thus we refrain from proposing any criteria in relation to timeframes, and instead recommend that developers consider factors that may influence clinical practice when making decisions in relation to framework updates. • The process of updating the framework can again be guided by our six-step model. As with the initial development process, developers should report both processes and outcomes of the update.

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Discussion and Considerations

Competency frameworks outline the features of competent professional practice. Multiple healthcare professions have developed competency frameworks; however, much of the existing literature has focused on the outcomes rather than developmental processes. Recent research on how competency frameworks were developed identified that existing approaches to developing competency frameworks risked decontextualizing clinical practice based on their limited inclusion of a number of relevant and influencing contextual features. The same review also identified variability in the use of methods, a lack of organising frameworks, inconsistent conformity to existing guidance, and inadequate reporting. To address these limitations, we suggested that future efforts to develop competency frameworks might be improved by acknowledging contexts, considering process and outcomes, and synthesizing existing guidelines. First, we synthesized and organized existing literature guiding the development of competency frameworks. Then we addressed identified deficiencies related to the role and relevance of contextual features by including a 'systems thinking' approach, which combined EST and complexity thinking. We then integrated our 'systems thinking' conceptual framework into a six-step competency framework development model. The six steps include (1) identifying purpose, scope, detail, timeline etc. (practicalities), (2) identifying system contexts and components using 'systems thinking', (3) using methods aligned with relevant sources and purpose, (4) translating data into competency frameworks, (5) reporting processes and outcomes, and (6) planning to evaluate, update and maintain competency frameworks. The model emphasizes an alignment with intended purpose and overall objectives and recognizes that changes occur over time, and as such competencies will need to be evaluated, updated and maintained. This we hope, provides developers with a theoretically grounded, principle based, and inherently flexible model designed to acknowledge variable practice across contexts [6].

Applying this proposed model across varying healthcare professions likely requires a series of negotiations and strategies with the profession and those around it to get done. Callon examined this in his Theory of Translation which helps to explore what those issues might be and how they might be organized. He talks of Problematisation, Interressement, Enrolment, and Mobilisation [72]. Problematisation occurs when an actor (e.g. those developing competency frameworks) defines a problem (e.g. inadequate competency framework) and positions themselves as a solution to that problem (e.g. develop an improved competency framework). Interressement is where relationships are made between actors to convince them that the definition of the problem is the right one (e.g. by supplying evidence such as literature that demonstrates competency frameworks are inadequate). Enrolment occurs where the users of the new knowledge take on the identities, roles and behaviours assigned to them (e.g. healthcare professionals as actors identify their practice through actively engaging with developing the competencies). Finally, mobilisation occurs when the newly created solution (e.g. improved competency framework) is mobilised and accepted by those involved until further translations occur or other interests intervene. Adopting this perspective requires developers to acknowledge that users of the competency framework should be involved in developing and translating data; they do not have to accept, and indeed can negotiate any roles assigned to them (e.g. when considering future competencies) [73]; and, they will accept a solution until such time as other interests intervene (e.g. workplace demands) or a new translation process occurs[74]. In other words, this perspective suggests that competencies as a product of

translation are only as useful as a profession considers them to be, and to ensure utility, the profession should be engaged and empowered in the ongoing translation process.

Our model requires a shift when developing competency frameworks from counting decontextualized approaches (e.g. what and how many methods) to aligning contextualized approaches (e.g. whether methods are fit-for-purpose and acknowledge the contexts of practice) [3]. As a result, developing competency frameworks may require significant investment in resources and time, particularly in relation to mixed-methods and evaluation. We acknowledge that developers are influenced by practicalities such as the perspectives and mandate of the developer, available resources, and timeframes [3]. However, we suggest that if the competency framework will be used to make decisions with significant implications (e.g., competent versus non-competent), then investing in appropriate resources such as expertise, time, and/or sources of data, appears to be not only defensible, but necessary in order to improve rigour. As such, the model is flexible in choosing methods that should be guided by the appropriate validity argument, while acknowledging practicalities. The use of 'systems thinking' guides developers in selecting methods, but also embraces the challenge of representing complex problems well. In other words, while we must appreciate that we may never **fully** capture the complex world of clinical practice, systems and complexity thinking can help us to expose components and relationships that further our understanding of clinical practice.

Outdated, or inaccurate representations of practice may continue to exist given the apparent lack of evaluation and update of competency frameworks highlighted in a previous review [3]. We argue that just as EST highlights considering changes over time within a system [22], so too must those developing competency frameworks consider changes in the system that impact professional practice and the competencies required to enact it [9,55,71]. The reported framework or its validity is never 'final'. While our model suggests means by which framework developers can improve how they develop their competency framework such that they can improve validity as well, how best to validate or evaluate outcomes (i.e. competency framework) requires further investigation. We suggest engaging those affected by the competency framework in the development process in order to validate the outcomes. In addition, framework developers may wish to consider a 'living document' approach whereby the framework becomes a dynamic document that can be revisited and revised. Such an approach clearly signals to users and stakeholders that outcomes may change as time progresses, contexts change, or practice evolves. As such, this will contribute to evaluating and maintaining a competency framework, which will in turn contribute to its continued validity and utility.

Considerations

One of the claims our proposal may be vulnerable to is that no single correct outcome exists for a complex problem [5,6]; much depends on the specific contexts and relationships. Therefore, just as no universal solution exists to a complex problem, there is no single 'correct' approach to describing clinical practice. We recognize that developers may wish to consider other approaches that provide insights neglected by our proposed model. Our model itself will need to be tested, and further research should examine its need for additional clarity and refinement. While the six step model, including its principles, can provide the starting point for reporting, some additional research is needed to define reporting guidelines, which outline the recommended items that should be included when reporting research studies [75]. The use of reporting guidelines may

increase the transparency of methods, and improve the translation of findings to practice [76]. Finally, while the steps of our proposed model are operational and functional, our model is conceptual, and we do not yet have the necessary data to provide a step-by-step process for how to implement it; thus it remains untested in the 'real world'. However, our use of paramedicine as an example to illustrate the application of the conceptual framework has provided us with further insights into our profession. We intend to use such insights to inform a future competency framework in paramedicine, and we will develop and evaluate the framework by implementing the six-step model.

Conclusion

Competency frameworks in healthcare professions are characterised by potentially inadequate descriptions of practice, variable developmental processes, and inconsistent reporting and evaluation, due in part to limited existing guidance. In order to improve how we develop future competency frameworks, we propose a six-step model that organizes existing guidance, and provides developers with a means to better represent the contexts and components of practice, and the competencies necessary to competently enact practice. We do so by proposing a 'systems thinking' approach (blending EST and complexity perspectives) to conceptualising clinical practice. The model provides developers with a logical organizing structure of principles to guide their assumptions and commitments when developing competency frameworks. Furthermore, the model acknowledges the flexibility required when we discuss professional practice across varying contexts, and further supports employing flexible, mixed-methods that are aligned with purpose and scope when developing competency frameworks. Finally, we provide synthesized and updated advice related to identifying competencies, reporting processes and outcomes, and evaluating, updating, and maintaining competency frameworks over time. We believe our model adds a unique and complementary means to conceptualise and improve the competency framework development process.

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