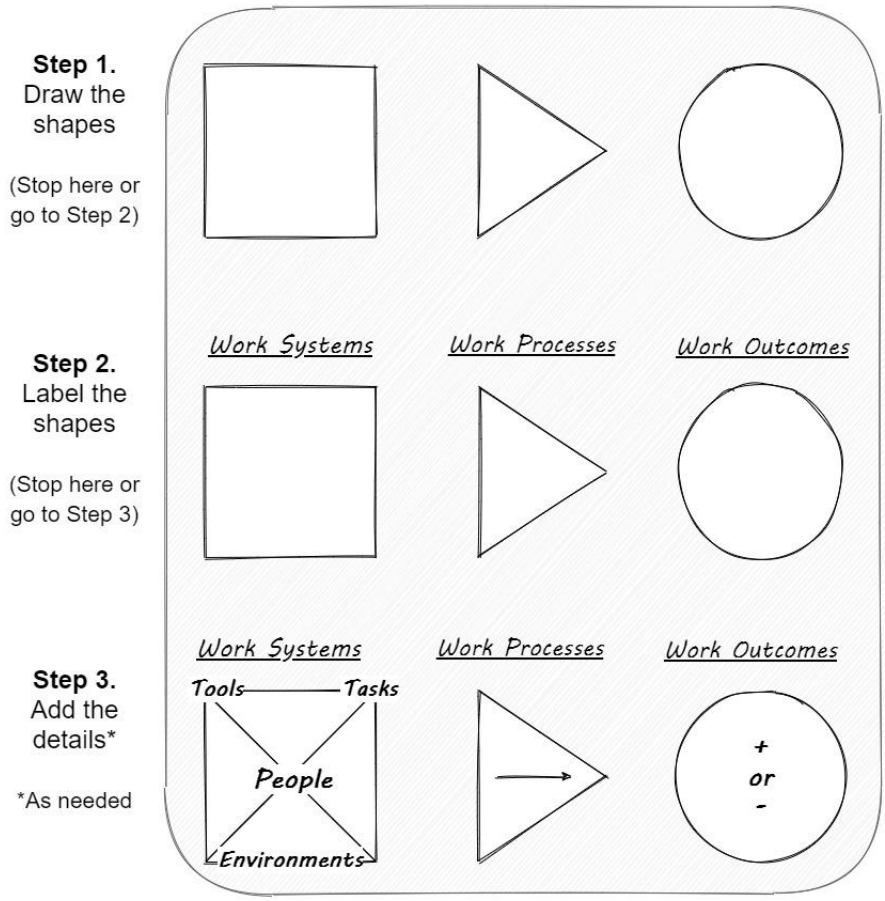
Online supplement

Appendix A. Drawing SEIPS 101.



Although it may seem trivial, drawing SEIPS 101 serves an important purpose. This visual artifact reminds us, for example, to: (1) put the person in the middle; (2) be aware of multiple factors in the work system; and (3) understand the interplay of systems, process, and outcomes. Drawing SEIPS is also a tool to communicate the above ideas to others—e.g., students, funders, or bosses—and instill in them a human-centered systems-oriented imagination. (SEIPS: Systems Engineering Initiative for Patient Safety.)

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Appendix B. SEIPS Tools templates.

Note: To use the templates, fill in the empty gray cells, resizing them to fit their contents. For Tasks, Tools, and Tasks X Tools Matrices, specify the relevant Tasks and Tools (italicized) and add rows and columns as needed.

PETT Scan Template

✓	**Factor**	**Definition**	**Barriers**	**Facilitators**
□	**People** -Patients -Healthcare professionals -Others	Individuals or groups of people and their physical (e.g., physical strength or reach), cognitive (e.g., knowledge), and psychosocial (e.g., motivation) characteristics		
□	**Environments** -Physical -Socio-organizational -External	Settings of activity internal to the unit of analysis or the surrounding external context, and the characteristics and influences of these environments		
□	**Tools**	Objects of varying technical advancement used to transform an input into an output and the characteristics of these tools, technologies, devices, or artifacts (e.g., usability)		
□	**Tasks**	Specific activities assigned or performed within a broader work process and the sequence and characteristics (e.g., complexity, difficulty) of those tasks		
□	**Interactions** between People, Environments, Tools, and Tasks	Factor-to-factor combinations and ways factors interact, e.g., how well a tool fits a task or how the social environment affects a person's behavior		

PETT: People, Environments, Tools, Tasks. SEIPS: Systems Engineering Initiative for Patient Safety.

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Tasks Matrix Template

Tasks Matrix						
	Who performs	Goal(s) of task	Frequency	How performed	When performed	Notes (or other dimensions)
Task 1						
Subtask 1a						
Task 2						
…						

Tools Matrix Template

Tools Matrix						
	Users	Purpose of use	Frequency of use	Ease of access	Usability	Notes (or other dimensions)
Tool 1						
Tool 2						
…						

Tasks X Tools Matrix Template

Tasks X Tools Matrix						
	Task 1	*Task 2*	*Task 3*	*Task 4*	…	Notes
Tool 1						
Tool 2						
…						

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Outcomes Matrix Template

		(a) Outcomes for:			(b) Notes and ratings		
		Patients/ Families	Healthcare Professionals	Organization	Priority / importance	Outcome likelihood	Measure(s) used
Proximal	Desirable				(Apply notes/ratings to each of the 12 gray cells in section (a))		
	Undesirable						
Distal	Desirable						
	Undesirable						

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Appendix C. SEIPS FAQ (April, 2021)

Over the years, we have fielded many practical questions about the Systems Engineering Initiative for Patient Safety (SEIPS) and the associated models. Below are the simplest answers to the most frequently asked questions (FAQ).

Q: Which version should I use?

A: The versions are similar, but each represent an advance or refocusing. For example, SEIPS 2.0 focuses on patient and family engagement, whereas SEIPS 3.0 emphasizes the concept of journeys. One cannot go wrong using the latest version among these. SEIPS 101 is distinct in seeking to simplify and distill the primary message of all the SEIPS Models and is therefore recommended for beginners, quick-and-dirty use, and early-stage efforts.

Q: What expertise do I need to get started using SEIPS?

A: Little is needed to get started beyond a commitment to systems thinking, i.e., Systems-Processes-Outcomes (with interactions and feedback loops between them), where systems are defined as dynamic interactions of multiple components that should be designed to support the people at their center. Expertise can be gained through education, hands-on training, and personal experience, or acquired by partnering with experts in human factors engineering, user-centered design, and other systems-oriented, human-centered disciplines. However, SEIPS 101 and the Seven Simple SEIPS Tools are explicitly meant for broad use by anyone, for various purposes.

Q: How do I pronounce SEIPS?

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A: Each individual is free to pronounce SEIPS as they like, to abbreviate SEIPS or spell it out, and to refer to the "SEIPS Model" or just "SEIPS." (For the curious, we pronounce it "seeps.") In the SEIPS acronym, the most meaningful letters are the "SE," which stand for "systems engineering." Although the "PS" refers to our initial focus on patient safety, the model is more broadly applicable. We will at times refer to the model as "The Work Systems Model" or "Sociotechnical Systems Model," to be more descriptive. We also offer this remedy for the common misspelling "SIEPS," which transposes the two vowels: remember that the "E" stands for "Engineering" and "Engineering should come first!"

Q: What is the cost of using the SEIPS 101 Model and the seven simple SEIPS Tools?

A: There are no usage costs or other requirements, apart from attributing the original creators, by custom. Individuals may redraw or modify the model and use it in their own materials, ideally retaining its essential elements. The SEIPS 101 Model is registered on creative commons to be licensed by attribution, or simply put: "distribute, remix, adapt, and build upon [the model], even commercially," as long as you cite it. Even more simply: do with it what you want, just do not claim all the credit. Our permission is not needed to use SEIPS, but we welcome hearing from its users.

Q: Why are things missing from SEIPS 101?

A: We realized there are trade-offs between completeness and simplicity; we favored the latter. Thus, although SEIPS 101 retains many essential aspects of the SEIPS family of models, it complements but does not replace its more comprehensive relatives.

Q: Are there step-by-step instructions for using SEIPS 101?

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A: To use the SEIPS 101 Model, apart from drawing or invoking it, we recommend using the Seven Simple SEIPS Tools (that is, after all, their purpose). We are currently developing further instructions and associated training opportunities for applying the tools, including both instructor-facilitated and do-it-yourself versions. Until then, prior publications on SEIPS and the authors of these publications are the best sources of assistance.

Q: Where did SEIPS originate?

A: SEIPS was originally an initiative of the University of Wisconsin-Madison, more particularly the Center for Quality and Productivity Improvement. The SEIPS Model combines the work system "balance model" of University of Wisconsin-Madison's Pascale Carayon and Michael J. Smith with Donabedian's Structure-Process-Outcome model for assessing healthcare quality. SEIPS shares many theoretical underpinnings with general systems, open systems, and sociotechnical systems theories, which have produced similar systems models applicable beyond health and healthcare. Although SEIPS was first developed and used in the healthcare domain, its broader theoretical basis makes it applicable to other sociotechnical systems where effort is expended in pursuit of meaningful goals.

Q: For what purposes is SEIPS used?

A: Our reviews of published literature reveal that most use it to structure data collection and analyze those data to describe systems phenomena, often in the context of research. However, SEIPS can be and has been used more broadly to plan and evaluate interventions, guide implementation of new initiatives, organize education or training programs, inform policies, and advance new theories and methods. There are many uses of the SEIPS Model and

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the introduction of formal SEIPS Tools should support additional uses beyond descriptive research.

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