

Improvement Cymru Academy Toolkit Guide



Systems Engineering Initiative for Patient Safety 3.0

Introduction

Patient safety incidents result from multiple interactions between work system factors. Systems Engineering Initiative for Patient Safety (SEIPS) provides a framework for improving quality and safety in healthcare and integrates human factors and ergonomics. Healthcare is a complex socio-technical environment with multiple interactions between humans and technologies. SEIPS facilitates a learning response to examining a problem or incident that examines the different work system components and their interactions, focussing on wider system issues, not individuals. Diagram 1 below shows an overview of the SEIPS 3.0 framework.

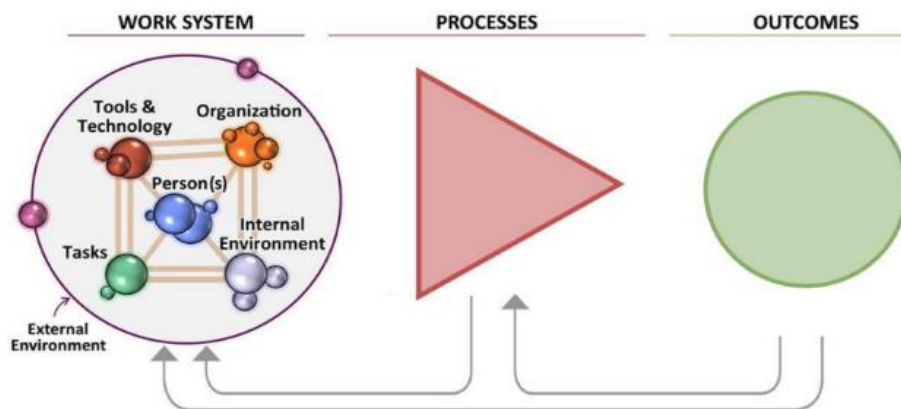


Diagram 1 below shows an overview of the SEIPS 3.0 framework.

The SEIPS 3.0 framework consists of a work system, processes, and outcomes. The **work systems** consist of six elements which are the external environment, tools and technologies, organisation, internal environment, tasks, and person(s). Each of the elements have multiple factors that affect the work system, such as culture, policies, equipment, resources, skills, etc... The person is at the centre of the work system because people cannot be separated from their working environment and emphasises that the work system design should support people and not compensate for them. The **process** refers to the patient journey and considers the distribution of patient interactions within multiple healthcare settings. The **outcomes** refer to the consequence of the work system and the process. It can be related to patients through patient safety, quality of care, satisfaction, and health status. It can also be related to staff such as quality of work life, stress, and burnout. There are also **feedback mechanisms** within with framework to show how the different

components are connected and influence each other. These are depicted by the arrows at the bottom on the diagram shown above.

Rationale

The SEIPS 3.0 model focuses on the patient journey and provides a human centred approach. The SEIPS 3.0 model can be used to identify challenges of patient safety at the boundaries of differing work systems such as primary to secondary care, handovers, referrals etc... and identify opportunities for improvement. This it enables you to evaluate your work systems and processes in relation to patients and staff. SEIPS 3.0 applies the principles of Human Factors to the patient journey within a complex environment and encourages engagement from patients, families, and caregivers in the design of how patients move through the system and then builds on this to make improvements (see our [Human Factors Toolkit Guide](#) for more information).

Background

The SEIPS framework was developed from the University of Wisconsin-Madison by a group of multidisciplinary researchers led by Professor Pascale Carayon. The framework was developed in collaboration with healthcare practitioners and various stakeholders. The original framework was created in 2006 but evolved over time to the SEIPS 2.0 framework in 2013. The SEIPS 2.0 model expanded on the work system and incorporated the concept of the sociotechnical system to describe the interactions and independencies amongst the elements within the work system. The SEIPS 2.0 model then evolved to the SEIPS 3.0 model which expanded the process component incorporating the concept of the patient journey to describe the interactions the patient has with multiple teams in multiple healthcare settings. A simplified version of the SEIPS model was published (Holden and Carayon, 2021) called SEIPS 101. This offers an easy to use and practise orientated version of SEIPS that can be used regardless of familiarity with the SEIPS model.

When to use

The SEIPS 3.0 can be used as a problem-solving tool to help you understand your system, identify root causes of patient safety incidents and guide improvement efforts. SEIPS 3.0 can also be used when designing and evaluating change ideas

and interventions and facilitate engagement of patients, families, and caregivers in the patient journey.

How to use

Step One

To use SEIPS 3.0 framework you will first need to define the problem (see our [Understanding Your problem Toolkit Guide](#)). This could be a quality improvement project you are undertaking or a patient safety incident. Appendix 1 gives information about the contributory factors to patient safety within each element of the work system and Appendix 2 gives questions to help you identify areas for improvement within each of the work elements. You can use the template in Appendix 3 to make notes for each of the elements of the work system. (All Appendices can be found at the end of this toolkit guide.)

Step Two

Identify the work system, process and outcome components that are relevant to your problem or aim.

	Tools and technology	Tasks	Person	Internal environment	External environment	Organisation
Patient						Implement a patient safety culture programme
Employee						
Organisation						
Process						

Diagram 2: Intervention matrix tool

Step Three

You will need to analyse the interactions amongst the components and how they affect each other and generate solutions that will improve the work system, process, or outcome. To do this you could use an intervention matrix tool which describes the components of the work systems across the top; the columns represent the four

types of outcomes, as shown in diagram 2. Within each cell you would have a possible intervention that corresponds with an outcome. As you can see in the diagram you could implement a patient safety culture programme against the outcome of the patient. This can help you brainstorm and categorise ideas into the different elements.

Step Four

Implement and monitor the solution and assess how it effects the work system, the process, and outcome. You can monitor this with quantitative or qualitative data relating it back to the work element and the impact it has on the outcome. Performing an evaluation matrix can help you assess the effectiveness and the impact of your chosen intervention. It compares the expected outcomes and the actual outcomes of the interventions and contains information on how you will monitor and evaluate the impact. It can help you determine if you have achieved your objectives, identify factors that influence outcomes, and allows you to see where further improvements need to be made. Diagram 3 shows an evaluation matrix using the example from the intervention matrix in the last step along the second row under the organisational work element, however this one intervention could have an impact on other areas as shown in the rest in the table. You can have more than one evaluation for each work system element.

Work System Element	Outcome Type	Expected Outcome	Indicator	Method	Actual Outcome	Evaluation
Organisation	Patient	Improved patient safety culture	Safety Attitudes Questionnaires	Survey	Increased by 21%	Positive
Tools and Technology	Process	Reduced medication errors	Number of medication errors reported	Datex incident reports	Decreased by 28%	Positive
Tasks	Employee	Enhanced job satisfaction	Questionnaires	Staff Survey	Increased by 46%	Positive

Person(S)	Organisational	Increased staff retention	Turnover rate	Human resource data	Decreased by 34%	Positive
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Diagram 3: Evaluation Matrix tool

Step Five

Using the previous steps in this process, can help you learn and adapt from the results and feedback of your interventions and make adjustments if needed. This is not a linear process but a continuous process of learning and improvement.

What's next?

Start by familiarising yourself with the basic concepts and principles of the SEIPS 3.0 framework (see references below). To use this framework effectively you will need to consider the scope of the process you want to investigate, you will also need to consider the perspectives of multiple stakeholders. To engage with the right stakeholders, it would be useful to perform a stakeholder analysis (see our [Involving Others Toolkit Guide](#) for more information).

Helpful tips

When using SEIPS 3.0 it is useful to start with a specific problem and have a clear goal of what you want to address. Examples of this could be to understand how a patient incident occurred, how to improve a process, or how to design a new intervention. Consider the patient journey and how it spans across multiple care settings at the same point in time. Involve multiple stakeholders such as patients, families, carers, clinicians, administration staff and managers in the SEIPS process.

Additional resources

If you are interested learning more about improvement please visit our website <https://phw.nhs.wales/services-and-teams/improvement-cymru/improvement-cymru-academy/> or email us at improvementcymruacademy@wales.nhs.uk to find out about the improvement courses we offer.

Further reading

Carayon, P., Wetterneck, T.B., Rivera-Rodriguez, A.J., Hundt, A.S., Hoonakker, P., Holden, R., Gurses, A.P. (2014). Human Factors Systems Approach to Healthcare Quality and Patient Safety. *Applied Ergonomics*. 45(1), pp14-25. Accessed from: <https://europepmc.org/backend/ptpmcrender.fcgi?accid=PMC3795965&blobtype=pdf> (Accessed 27 Nov 2023)

Carayon, P., Woolridge, A., Hoonakker, P., Hundt, A.N., Kelly, M.M. (2020). SEIPS 3.0: Human-Centered Design of the Patient Journey for Patient Safety. *Applied Ergonomics*. Accessed from: <https://www.sciencedirect.com/science/article/pii/S000368701930239X> (Accessed 27 Nov 2023)

Grimes, T. C. (2021), Is it time for greater patient involvement to enhance transitional medication safety? *British Medical Quality and Safety Journal*. Accessed from: <https://qualitysafety.bmj.com/content/qhc/early/2021/08/19/bmjqs-2021-014116.full.pdf> (Accessed 27 Nov 2023)

Holden, R.J., Carayon, P. (2021). SEIPS 101 and Seven Simple SEIPS Tools. Accessed from: <https://www.rcpjournals.org/content/futurehosp/8/3/e593> (Accessed 27 Nov 2023)

NHS England. (2022). SEIPS Quick Reference Guide and Work System Explorer. Accessed from: <https://www.england.nhs.uk/wp-content/uploads/2022/08/B1465-SEIPS-quick-reference-and-work-system-explorer-v1-FINAL.pdf> (Accessed 27 Nov 2023)

Weaver, S., Stewart, K., Kay, L. (2021). Systems-based Investigation of Patient Safety Incidents. Accessed from: <https://www.rcpjournals.org/content/futurehosp/8/3/e593> (Accessed 27 Nov 2023)

Appendix 1 - Overview of the SEIPS 3.0 work system (NHS England, 2022)

Tools and Technologies:

Characteristics such as:
Usability, Accessibility, Familiarity,
Level of automation, Portability
and functionality, Maintenance.

Tasks:

Specific actions within a larger
work process
Includes task attributes such as:
Difficulty, Complexity, Variety,
Ambiguity, Sequence

Internal environment

Physical environment such as
characteristics of:
Ambient environment - lighting,
noise, vibration, temperature,
physical layout and available
space, housekeeping: cluttered,
organisation, cleanliness

Person:

Individual
characteristics:
Psychological impacts
(e.g. burnout, stress,
frustration), cognitive
factors (attention,
memory, confusion),
preferences, personal
goals, knowledge,
competence, skills,
physiological factors
(Illness, dehydration),
physical strength and
needs, collective
characteristics: team
cohesiveness

**External
environment:**

Societal, economic,
regulatory and policy
factors outside an
organisation

Organisation:

Structures external to a person (but
often put in place by people) that
organise time, space, resources, and
activity.

Within institutions:

Work schedules/staffing, workload
assignment, management and incentive
systems, organisational culture (values,
commitment, transparency), training,
policies/procedures, resources
availability and recruitment

In other settings:

Communication infrastructure, living
arrangements, family roles and
responsibilities, work and life schedules,
financial and health-related resources.

**Desired
Outcomes:**

Systems
Performance:
Human Wellbeing:

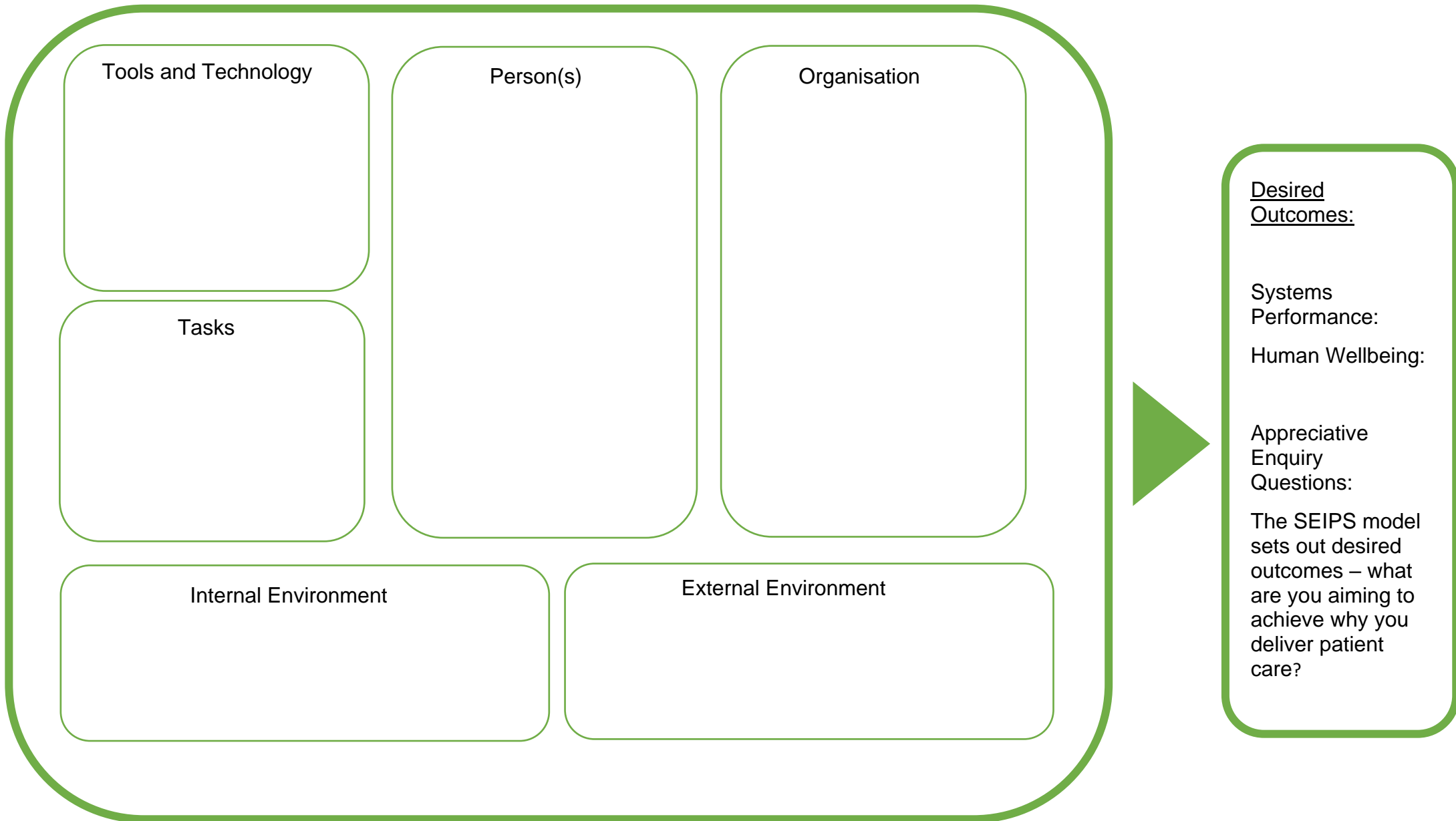
Appreciative
Enquiry
Questions:

The SEIPS model
sets out desired
outcomes – what
are you aiming to
achieve why you
deliver patient
care?

Appendix 2: SEIPS worker questions (NHS England, 2022)

<p><u>Tools and Technologies:</u></p> <p>Describe the equipment/tools you use, Describe equipment design, share insights into equipment reliability, describe how information is presented (e.g. paper records, IT system), describe alarms and alerts, are any tasks automated?, describe where equipment is positioned – is this optimal? Are tools/technologies maintained/up to date?, Are manuals, procedures, and supports accessible?</p>	<p><u>Person:</u></p> <p>Tell me about the patient mix, describe the team who deliver patient care, who else is part of the team (admin, domestics, porters etc...), how familiar are the team with care pathways/processes?, are roles and responsibilities clearly defined?, describe how training is organised to support safe care, describe the team dynamics, describe the impact of personal factors (e.g. stress, morale, tiredness)</p>	<p><u>Organisation:</u></p> <p>Tell me about how the patient pathway works, describe information flow (how is information communicated), what is the communication workload like?, tell me how new information is flagged, where is new information held?, describe the leadership and supervision arrangements, describe how works is scheduled/ allocated, describe staffing levels and resourcing, describe the safety/organisational culture, describe how change management works</p>
<p><u>Tasks:</u></p> <p>Tell me about the task demands you face, describe the tasks which are complex or challenging to carry out, talk me through the experiences of your workload, are there time pressures – if so tell me more, does task repetition or monotony occur in this work system?, do you have to re-prioritise or reorganise workload?</p>	<p><u>Internal Environment:</u></p> <p>Does the workspace support safe patient care/tasks performed?, Share your thoughts on the layout of the environment, Is the workspace appropriate for the task?, Where are the tasks completed?, Describe any distractions you face regularly, Do interruptions impact safe patient care, if yes, how?, Describe the impact of the ambient environment (e.g. lighting, noise, air etc...)</p>	
<p><u>External environment:</u></p> <p>Describe any relevant national targets, tell me how the following impacts (if at all):</p> <p>Policies and regulatory demands, accreditation standards, policy decision making, global events</p>		

Appendix 3: SEIPS Template (NHS England, 2022)



Tools and Technology

Person(s)

Organisation

Tasks

Internal Environment

External Environment

Desired Outcomes:

Systems Performance:

Human Wellbeing:

Appreciative Enquiry Questions:

The SEIPS model sets out desired outcomes – what are you aiming to achieve why you deliver patient care?