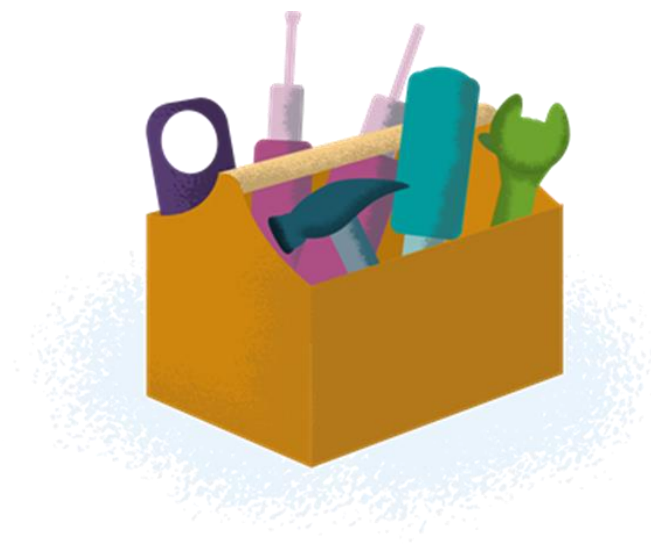# Improvement Cymru Academy Toolkit Guide

Reasons Swiss Cheese Model

What is Reasons Swiss Cheese Model?

The Swiss cheese model is a complex linear safety model of accident causation and is used in several industries such as aviation, engineering and healthcare for risk analysis and risk management and was created by Professor James Reason. The Swiss cheese model is a representation of human systems. Swiss cheese consists of randomly placed holes each randomly sized. The model depicts slices of cheese stacked side by side (as shown in diagram one). Each slice represents the defences integrated into the design of a system, that are designed to prevent patient safety errors occurring. For example, a cheese slice could be culture, education, or training. Whilst each slice or defence, should remain intact, there are unintended weaknesses in every system. These weaknesses are represented as the holes in the cheese. If an error occurs and breaks through a hole in one slice, it does not usually result in a adverse outcome because there are other defences in place that prevent the adverse outcome. However, when each hole aligns in multiple slices (meaning that all defensive layers have been broken), it will bring hazards into contact with patients and causes harm. Holes (weaknesses) within the system arise for two reasons: **Active Failures** and **Latent Conditions**.
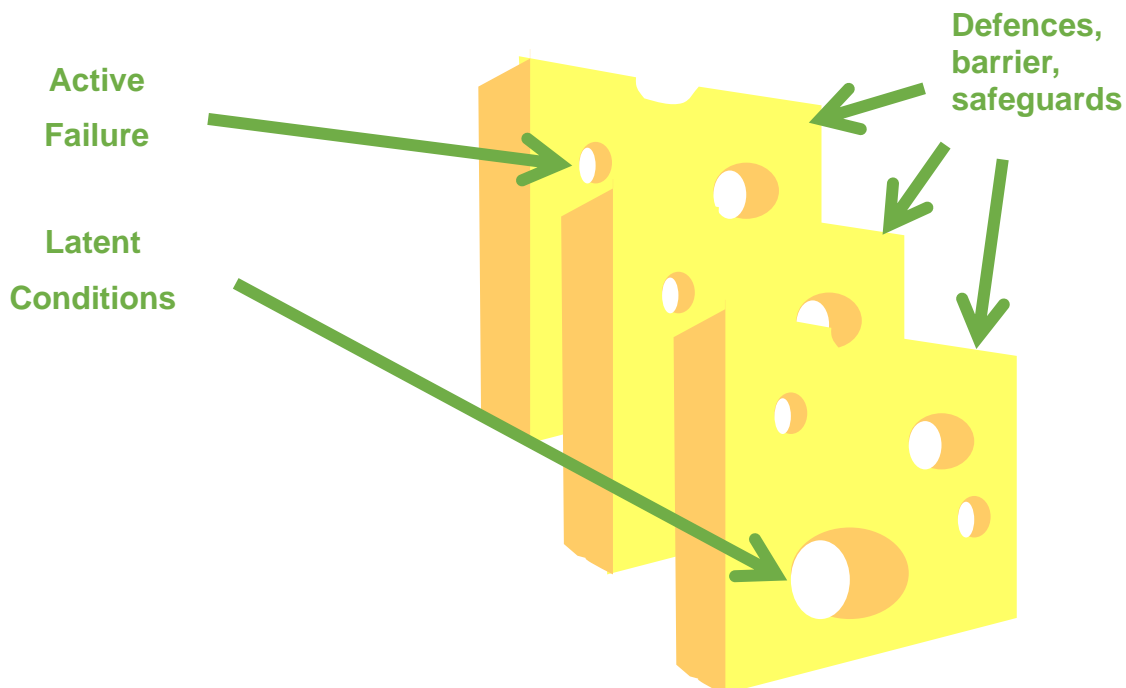

Diagram one: The Swiss Cheese Model

Rationale

The Swiss Cheese model is a framework for understanding how incidents or errors occur within complex systems and how they can be prevented. This model would be used to identify and address the holes in each layer of defence and try to make them as small as possible and as infrequent as possible. This model can also help to understand how human factors contribute to incidents or errors and how we can improve this by examining the slides of cheese which represent the design of the system, culture, education, and training etc…

Background

Professor James T. Reason who was a renowned professor in safety psychology at the University of Manchester, created and published the Swiss Cheese model in his book *Human Error* in 1991. In his book he refers to accidents happening because of many interconnected factors and not due to one or more independent factors. One of the examples he uses is the 1986 challenger disaster - a historical event where a space shuttle exploded, 73 seconds after lift-off and killed all seven people on board. When the Swiss Cheese model was applied to this event, several factors were identified that contributed to the accident:

1. **Management Deficiencies** – Concerns were raised from engineers and there was ineffective communication with each other and the crew.
2. **Inadequate Controls** – Inadequate quality control and testing procedures for O-ring components.
3. **Physical failures** – O-rings failed to seal properly.
4. **Unsafe acts** – no emergency procedures or escape systems.

This demonstrates how multiple factors can align and break through defence systems which results in a failure or error.

How to use it?

Reasons Swiss Cheese model is a way of understanding how accidents happen in complex systems. The framework is based upon the idea that accidents are not

caused by a single factor but are caused by a combination of weaknesses within a system. These weaknesses are referred to as Active Failures and Latent Conditions.

Active Failures

Active Failures are described as unsafe acts by people that are in direct contact with patients. These usually have an immediate and visible consequence such as injury or death. Active failures can be categorised into slips, lapses, mistakes, and violations.

- **Slips**

Slips happen when a person intends to do something but does something else by mistake. Examples of this could be pressing the wrong button on a piece of equipment or puts a patient on the wrong pathway e.g. routine instead of urgent

- **Lapses**

Lapses happen when a step in the plan is forgotten. Examples of this are when you forget to set your alarm for the morning or when you don't check a patient's ID when taking bloods.

- **Mistakes**

Mistakes occur because rules are misinterpreted. Examples of this could be following an out-of-date protocol or lack of training or skill.

- **Violations**

Violations are deliberate deviations from rules that are there to ensure safety. Examples of this could be speeding in a vehicle or not performing a pre-theatre checklist to save time.

 Active failures are easier to notice but are usually influenced by latent conditions.

Latent Conditions

Latent conditions are harder to notice because they are usually hidden in the design of the system or organisation. Latent conditions include examples such as poor

organisational culture, poor equipment, short staffing, poor design, lack of supervision, lack of education and training, unclear policies, conflicting goals etc… Latent conditions can remain dormant for a while until they are triggered by an active failure. Examples of latent conditions would be if there was faulty wiring in a building and an operator plugs in a machine which caused a fire, or a ward may be short staffed, and a nurse gave the wrong medication to a patient which caused harm.

When to use it?

The Swiss cheese model can be used to analyse the causes of error to identify the active failures and latent conditions that caused them. You could also use the Swiss Cheese model as a preventative measure by improving the layers of defence which will reduce the holes in each of the layers. From this you can create a plan of ways to mitigate against error and implement safety measures.

What Next?

To use the Swiss Cheese model effectively, you need a positive safety culture and a just culture where your team will be able to speak freely without being blamed. Psychological safety needs to be present for your team to speak out if there are any concerns or potential risks. Start by having a conversation with your team and put together some ground rules to start creating a positive safety culture.

Helpful tips

Identify any potential hazards and risks within your processes and/or organisation. Identify what could go wrong and list the consequences. You could analyse the effectiveness of the layers of defence – consider human, technical, and organisational factors that could help you improve them. Continually monitor and evaluate the performance of your systems and outcomes using audits, inspections, feedback loops, incident reporting and complaints to help identify areas for improvement.

Additional Resources

If you are interested in learning more about how improvement practices can benefit your workplace, we offer a range of training courses. Visit our website for more information.https://phw.nhs.wales/services-and-teams/improvement-cymru/improvement-cymru-academy/ or email us improvementcymruacademy@wales.nhs.uk to find about the improvement courses we offer.

Further reading

Teitel, A.S. (2018). What Caused the Challenger Disaster? Accessed from: https://www.history.com/news/how-the-challenger-disaster-changed-nasa (Accessed 01 Nov 2023)

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