Understanding human factors in patient safety when prescribing

Rebecca Coon, Senior Lecturer, University of Sunderland

Keith Holden, Principal Lecturer, University of Sunderland

RPS Competency Framework for all Prescribers

This unit will address the following competency statements:

7.2. Knows about common types and causes of medication and prescribing errors, and knows how to minimise their risk.

7.4. Recognises when safe prescribing processes are not in place and acts to minimise risks.

7.5. Keeps up to date with emerging safety concerns related to prescribing.

By the end of this article, you will be able to:

- Describe the prevalence and types of prescribing errors which commonly occur;
- Understand the relationship between human factors and patient safety;
- Apply knowledge of human factors in a clinical or professional setting;
- Recognise unsafe prescribing practices and develop potential strategies to the reduce the risk of prescribing errors.

Introduction

The principle of 'patient safety' is preventing avoidable patient harm in healthcare (1). It has been suggested that 1 in 30 patients are affected by preventable medication-related harm, with the highest prevalence (around 50%) occurring during prescribing (2). If you consider this statistic in the context of an average prescriber, a pharmacist who prescribes for 10 patients a day could potentially cause a medication-related harm every 6 days. As more pharmacists take on prescribing roles, it is essential that they understand patient safety to ensure the safe and effective use of medicines. However, 'to err is human', and patient safety efforts should not blame healthcare professionals for mistakes, but instead support their work in often flawed systems, attempting to make those as safe as possible (3). To tackle patient safety from a prescribing perspective, it is necessary to recognise the fallibility of human nature and debunk the myth that if you try hard enough, you will not make errors.

This article will discuss the common factors contributing to prescribing errors, the challenges pharmacist prescribers face, and how understanding 'human factors' can help in developing safe prescribing practices and reduce error risk.

The changing role of pharmacists driven by prescribing

As pharmacist prescribing continues to grow (4) it is essential that the responsibilities for, and complexities of, patient safety are understood (5). As the pharmacist role evolves, it is likely that increased clinical responsibilities may accelerate the delegation of process and technical aspects of medicines supply to others. As pharmacists look to enhance their prescribing skills and expand their prescribing scope of practice, it is necessary to proactively engage with systems and working practices that prevent errors and promote a safety-first approach to patient care.

While some pharmacists have long benefited from advanced practice roles, (with an associated increase in professional satisfaction and perceived improvement in patient safety and outcomes), there are also factors which can limit pharmacist development in these roles (6). Rosenthal *et al* noted that 'pharmacist culture' can be a barrier to pharmacists advancing their clinical practice as independent prescribers (7). They highlighted the

tendency of pharmacists to be risk-averse, which can make clinical decision making more difficult when working in the 'grey' areas of patient care, where outcomes of intervention are less defined and more probabilistic in nature (7). This is particularly relevant as prescribing becomes more complex, caused in part by polypharmacy in an aging population with an increasing burden of long-term conditions and amplified by new pharmacotherapies (8). To work safely as a prescriber, it is important to develop a deepened understanding of errors, risk and how systems and culture can influence the way individuals approach their work with patients.

The prevalence of prescribing errors

The Chartered Institute of Ergonomics and Human Factors Pharmaceutical Human Factors Special Interest Group defines safety as "the level of system performance required to keep the incidence of harm (and risk) as low as reasonably practicable" (9). It's important to recognise that the level of acceptable risk will vary depending on the specific situation. For example, acceptable risk in a life-threatening situation will be different to acceptable risk in a self-limiting condition. Therefore, pharmacist prescribers require a change in mindset in order to be accountable for prescribing decisions, taking a more flexible approach to assessing risk when making an intervention (10). However, it is also necessary to distinguish between unavoidable and avoidable risk and recognise the importance of preventing patient harm from avoidable medication errors.

Medication errors are a significant concern in healthcare systems worldwide. In England alone it is estimated that over 200 million medication errors occur annually (11). Medication errors can have far-reaching consequences for patient wellbeing, health systems, and practitioners. Most result in no, or low-to-moderate, harm; however, some result in severe harm or death (12) (13) (14). From a purely financial perspective, the annual cost of avoidable medication errors for the NHS is around £100 million (11).

Errors can occur in all stages of the medication process, including prescribing, dispensing, administration and monitoring. A study of acute hospital trusts in north-west England identified around 9 errors per 100 medication orders, with prescribing errors made by all grades of doctors, including consultants; the highest risk was at admission to hospital (12). A

systematic review found a high rate of avoidable prescribing errors to be an international problem, with an overall median error rate of 7% (interquartile range 2–14%) of medication orders (15). A study involving 15 general practices in England found that around 1 in 20 prescribed items had either a prescribing or monitoring error, with 1 in 550 prescribed items associated with a 'severe error' (13,14). The most common errors were incorrect dose or strength, incorrect timing of dose and incomplete information (e.g. co-amoxiclav prescribed for sinusitis with no dose or frequency specified on the prescription) (14).

Most published research about prescribing errors focuses on prescribing by doctors, with relatively little known about the prevalence of prescribing errors made by other healthcare professionals. In 2015, the prevalence of prescribing errors by pharmacists was evaluated, with only 4 errors (0.3%) reported out of 1,415 prescribed medications over a 10-day period (16). More recently, a 2021 investigation at an acute NHS trust compared errors by pharmacist prescribers with those by doctors. The error rate for pharmacist prescribers was numerically lower (0.7%), compared with the rate for doctors (9.8%) (17). Although it is tempting to conclude that prescribing pharmacists are 'safer', it should be remembered that both studies were small, conducted in single-hospital trusts, and probably did not compare like-with-like prescribing activities. Further, robust research is required in this area before definitive safety statements can be made.

Despite not yet being able to determine the exact prevalence of prescribing errors, absolute and comparative rates between types of prescribers remains a pressing issue, particularly for the commissioning of safer clinical services. The potential range of causes of prescribing errors requires a multifaceted approach to risk minimisation, including consideration of both systems design and human factors.

Case in practice - Critically analysing risk of errors

When considering ways to minimise risk of error it is important to look critically at existing processes and identify points where errors could potentially occur. Consider the following case study:

A 77-year-old female presents with a history of episodes of breathlessness and palpitations. On examination, she is found to have atrial fibrillation (AF), and you consider prescribing an anticoagulant.

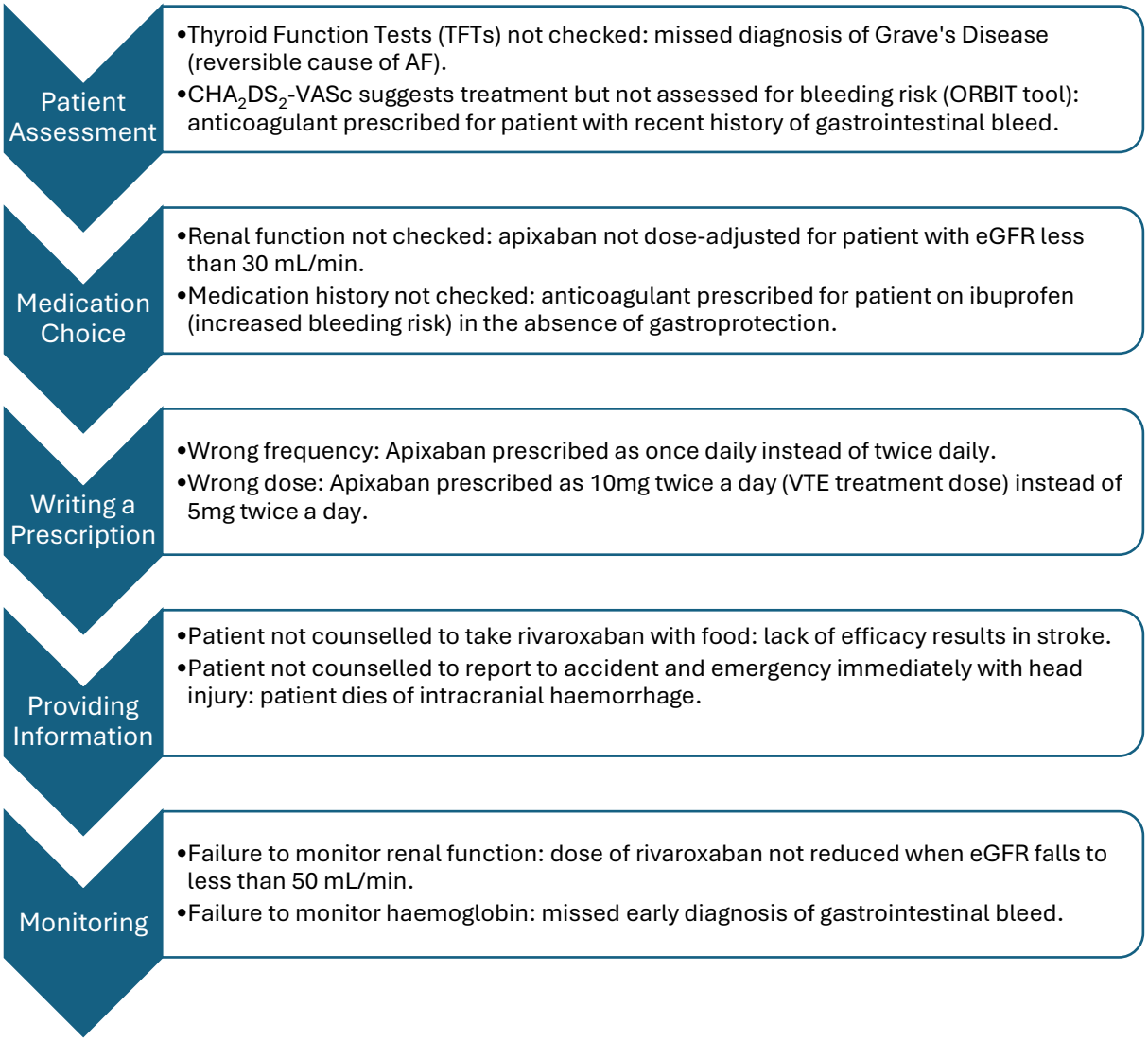
Consider this scenario:

- List all the stages of prescribing;
- Think of at least one error that could occur at each stage.

Outline answer guidance is available at the end of the article.

Possible answers

The prescribing process is complex and has several stages, with the potential for errors to occur at one or more stages of the process. It is not possible to consider every possible error but here are some suggestions for each stage:



What are human factors?

As the previous activity has shown, there are countless ways that medical errors could potentially occur. It is vital that the underlying causes of and opportunities for prescribing errors are well understood and that steps are taken to mitigate against them. The application of human factors can greatly aid and improve this process (9). Human factors refers to environmental, organisational and task factors, as well as individual physical and mental characteristics, that can impact on safety (18). It has been suggested that all healthcare professionals develop human factors competencies to help them perform effectively and safely within complex healthcare systems (9). This is particularly pertinent for pharmacist prescribers, as the majority of medication errors are attributed to prescribing (2).

The focus of human factors in healthcare is on understanding human behaviour and human limitations (19). This enables the design of technologies, environments, and processes to optimise performance through system-wide improvements, improving patient safety and the well-being of patients and clinicians (18) (20).

Aviation is often cited as an industry that has successfully applied human-factor interventions, such as checklists and 'sterile cockpits', to reduce risk and improve safety.

The term 'sterile cockpit' originates from aviation regulations and refers to critical phases of flight when flight crews must refrain from non-essential activities or conversations to prevent distractions (21).

Its success is frequently cited in support of widespread adoption of human factors in healthcare (22) with attempts made to apply and adapt learnings. For example, application of the 'sterile cockpit' theory to medication rounds aims to remove distractions during medicine administration, theoretically allowing greater focus on process and reducing error (23). Those involved in aviation safety consistently advocate for the application of human factors; tellingly, the pilot of the Hudson River aircraft incident, Captain Chesley Sullenberger, commented that the aviation industry would "close down" if the same number of fatalities happened in aviation as occur from prescribing errors (24). However, it is also recognised that healthcare has features that require the transfer of learning from aviation to be nuanced (23). One factor is the variability and complexity of patients, compared with aircraft (22). Another is that the scale of the intervention differs drastically – a single safety intervention in aviation would affect all the passengers on an aircraft simultaneously, whereas a safety intervention in healthcare would need to be repeated on hundreds of individual patients to have the same impact.

Understanding the relationship between human factors and patient safety

The Swiss cheese model, proposed by psychologist James Reason, illustrates that harm often results from a series of small mistakes that align in complex systems, rather than being a result of a single, catastrophic, error (Figure 1). Even the most robust systems will have

weaknesses, which are the 'holes' in the Swiss cheese analogy; given a certain set of circumstances, those weaknesses will align, allowing an error to occur (25).

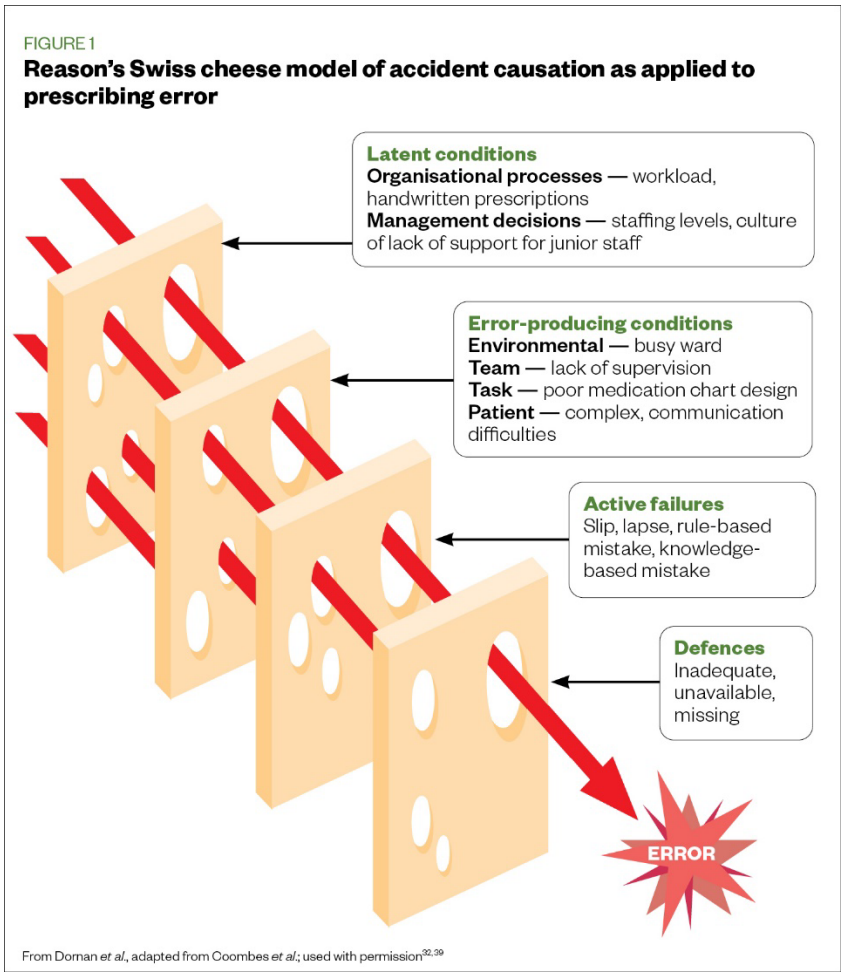


Figure 1: Reason's Swiss cheese model of accident causation as applied to prescribing error (26).

For example, when a patient is prescribed a medication there will be several layers of defence to prevent an error occurring: electronic prescribing systems, electronic dispensing systems, and accuracy checking before, during, and after dispensing amongst others. However, most pharmacists, during their careers, will experience examples of failures in all these defensive layers.

Reason's model described two main ways in which humans contribute to errors: active failures and latent failures. Active failures are unsafe acts or omissions by the person whose

actions have a measurable, unintended, consequence, for example a prescriber who makes a calculation error resulting in the overdose of a patient and subsequent toxicity (27).

Some other examples of active failures include:

- Mistakes (where the treatment plan itself is inadequate). These are rule or knowledge-based mistakes, for example writing a prescription for 300mg, not knowing that the correct dose is 100mg.
- Slips/lapses (where the action doesn't go to plan). These are omissions, memory or attentional failures, for example intending to write a prescription for 100mg but writing 300mg instead due to lapse in concentration or forgetting to prescribe a drug due to interruption.
- Violations (where a deliberate action is taken that proves to be harmful). These involve deviating from a protocol or standard operating procedure (SOP), for example prescribing lithium without checking that appropriate monitoring has been carried out due to lack of time.

Latent failures are the underlying factors that affect the conditions in which errors occur. They may be caused by decisions made by a person outside of the workplace – for example, senior managers, commissioners or policy makers. These decisions might result in conditions such as a stressful working environment, inadequate systems, or poor maintenance of equipment, all of which can contribute to errors (28).

Vincent *et al* applied Reason's Swiss cheese model to patient safety in healthcare, introducing a framework of seven factors that influence clinical practice. The framework has been used to investigate errors in healthcare (20), promote the examination of influences at each stage of clinical practice, and to make interventions that improve patient safety (28).

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Box: Factors that influence patient safety in clinical practice (28) (29)

- ***Institutional context*** (e.g. national policies; regulatory standards)

- ***Organisational and management factors*** (e.g. safety culture; financial resources; organisational structure; staff training and education)
- ***Work environment*** (e.g. workload; staffing levels and skills mix; availability of drugs, equipment and supplies)
- ***Team factors*** (e.g. verbal and written communication; team structure; team goals)
- ***Individual (staff) factors*** (e.g. knowledge and skills; physical and mental health; motivation)
- ***Task factors*** (e.g. familiarity or difficulty of task; availability and use of protocols)
- ***Patient characteristics*** (e.g. complex medical history; language barrier; social factors)

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The Systems Engineering Initiative for Patient Safety (SEIPS) model (Figure 2) further adapts this framework and considers how interactions between different work-system factors produce different outcomes (as opposed to simple cause-and-effect relationships) (30). The framework can be considered a more holistic view and identifies six broad elements within work systems: the internal and external environment, organisation, person, tasks, and tools and technologies. Modulated differences in interactions between each component results in different outcomes, both for patients and employees (30). Crucially, the framework recognises that people are central to the work system, and that systems should be designed to support people at the centre of the system (31).

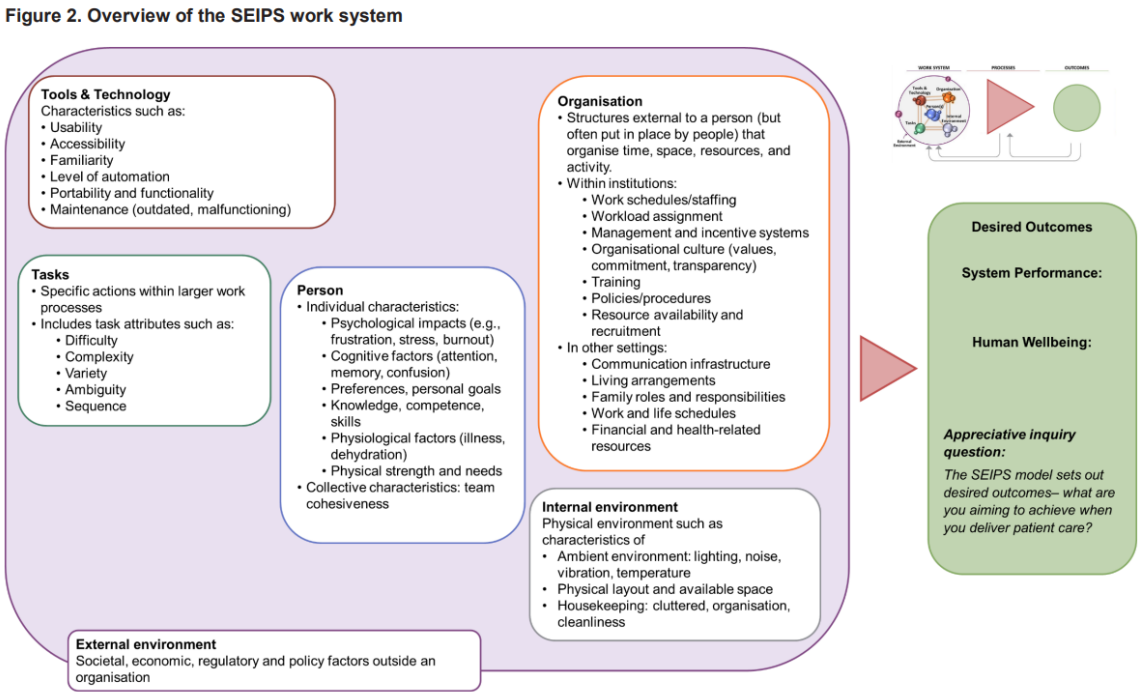

Figure 2: Overview of the Systems Engineering Initiative for Patient Safety (SEIPS) work system (32)

The SEIPS model can be used proactively to help design systems or reactively to help investigate incidents (30). An NHS trust used the SEIPS model to identify several systems issues that were leading to prescribing errors on admission. The investigation involved considering the people, tasks, tools and technologies, physical environment and organisational conditions involved during the medicines-reconciliation process carried out by junior doctors. This human-factors-led system analysis resulted in a variety of interventions, including a relatively simple intervention of improving junior doctor access to GP records by issuing more individual NHS smartcards. (33). Although simple, this intervention may not have been identified and implemented if each prescribing error was considered to be solely the fault of the prescribing doctor and dealt with on an individual basis. By considering how the design of work systems influenced processes and affected outcomes, the intervention improved the medicines-reconciliation process for all prescribers.

How human factors can improve patient safety

Although it is difficult for most individuals to address wider organisational factors, pharmacist prescribers can be effective vectors for change through proactive feedback to managers via both formal and informal mechanisms. In addition, by recognising some of the human factors that affect themselves and their teams, prescribers can apply the principles already outlined to improve patient safety, personal performance, and wellbeing (31).

For instance, it is well-known that sleep deprivation and tiredness can significantly impair key neurocognitive functions, such as attention, decision making, and working memory, increasing the risk of errors (34). However, this knowledge is not extrapolated to healthcare environments, where complex decisions are often being made by fatigued members of the team.

Other factors that can affect personal performance include hydration, nutrition, and stress. HALT (Hungry, Anxiety/anger, Late/lonely, Tired) is a useful mnemonic for considering these personal factors; stopping for a moment to improve your personal performance could have a positive impact on patient safety and team working (31). The I'M SAFE (Illness, Medication, Stress, Alcohol/drugs, Fatigue, Eating and elimination) checklist is another example of a simple self-assessment tool that can be used to assess your current ability to perform safely (35).

Effective communication is also a behavioural factor commonly linked with medication errors. One suggestion is to imitate the aviation industry, in which all essential communication is verbal and staff are trained to be unambiguous and to read back safety-critical information (36).

Loss of situational awareness can happen when all of the information is available, but not acted on appropriately, possibly due to distraction or intense concentration on a specific task (tunnel vision) (37). This can be prevented in a team that is actively supporting its members, and in which team members feel empowered to voice their concerns (31).

Strategies for pharmacist prescribers to improve patient safety

Pharmacist prescribers can apply the principles of human factors to enhance patient safety by focusing on optimising the interaction between people, systems, and environments.

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Activity 2: Minimising risk of error in a prescribing task

- Identify a prescribing task you would potentially undertake in your own working environment.
- Using the SEIPS model above, list the work-system factors that could affect your ability to carry out that task safely and effectively.
- For each work-system factor listed, think of one strategy that you could implement to reduce the risk of making an error.

Answer guidance: You could consider some of the following proposed strategies, based on the factors described in the SEIPS model (30):

Work-system factors	**Potential strategies**	**Examples**
Tasks	• Simplify complex processes where possible to minimise cognitive load.	• Develop a checklist or protocol for prescribing complex medications.
	• Engage patients in discussions about their medications; make prescribing decisions based on the needs of the patient (38) (39).	• Explain the purpose, dosage, and potential side effects to ensure understanding and that prescribing meets the patient's needs.

	• Ensure prescriptions and instructions are clear and concise; use standardised terminology and avoid abbreviations that could be misinterpreted.	• e.g. 'take one tablet three times a day' instead of '1 tab TID'.
Tools & Technology	• Take advantage of technology to support prescribing decisions, provide automated checks and reduce reliance on memory.	• Use electronic reminders for tasks that require follow-up, such as monitoring. • Acknowledge electronic alerts when prescribing (e.g. drug interactions).
Internal Environment	• Adjust the physical layout of the workspace to support efficient working.	• Place frequently used items within easy reach.
	• Optimise ambient conditions.	• Enhance noise, light and temperature.
	• Minimise disruptions or distractions when prescribing (40).	• Close down emails and turn phone to silent when prescribing.
Person	• Be aware of own knowledge, competence and skills.	• Arrange ongoing training to update knowledge and skills on latest evidence base, best practice and technologies (38).

	• Regular self-assessment e.g. HALT (Hunger, Anxiety/anger, Lonely/late, Tired).	• Take breaks to improve cognition and avoid dehydration. Be mindful of psychological impact and own mental health needs.
Organisation	• Collaborate closely with other healthcare professionals and foster a culture of open communication amongst the team.	• Implement a double-check procedure for high-risk medications.
	• Use data to identify trends and implement system-wide changes (41).	• Report incidents to allow analysis of medication errors and near misses.

Although it is unlikely that you will be able to implement all the strategies listed above, any that you can implement may help reduce the risk of making an error.

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Knowledge check

1. What is the primary goal of considering human factors in patient safety when prescribing medications?

   A) To reduce the time it takes to prescribe medications

   B) To improve communication between prescribers and patients

   C) To minimise the risk of medication errors

   D) To increase the cost-effectiveness of treatments

2. Which of the following best distinguishes between active and latent failures in the context of prescribing errors?

   A) Active failures are errors committed by frontline staff, while latent failures are systemic issues that predispose to errors.

   B) Active failures are only found in electronic systems, while latent failures occur exclusively in manual processes.

   C) Active failures occur during patient care, while latent failures occur after the patient has been discharged.

   D) Active failures are related to communication issues, while latent failures are caused by technology malfunctions.

3. What role does a prescriber's decision-making process play in ensuring patient safety when prescribing medications?

   A) It helps in choosing the least expensive medication for the patient

   B) It ensures that medications are prescribed based on standardised protocols only

   C) It involves considering patient-specific factors, such as allergies and existing conditions, to avoid potential adverse drug reactions

   D) It reduces the need for patient follow-up appointments

4. Which strategy is most effective in reducing the impact of human factors on prescribing errors?

   A) Relying solely on automated systems to check for errors

B) Encouraging multidisciplinary collaboration and communication among healthcare providers

C) Allowing only senior doctors to prescribe medications

D) Limiting the number of medications a patient can be prescribed

5. According to the SEIPS (Systems Engineering Initiative for Patient Safety) model, which of the following is **NOT** considered a work system factor that influences patient safety?

   A) Tools and technologies

   B) Organisational culture

   C) Task design

   D) Patient's socioeconomic status

Further resources

- **World Health Organization (WHO) - "Medication Without Harm: WHO Global Patient Safety Challenge"**
  https://www.who.int/initiatives/medication-without-harm
- **The Human Factor: Learning from Gina's Story**
  https://www.youtube.com/watch?v=IJfoLvLLoFo
- **Clinical Human Factors Group**
  https://www.chfg.org/
- **NHS England elearning for healthcare – "Human Factors / Ergonomics (Safety Science) for Patient Safety: Level 1"**
  https://www.e-lfh.org.uk/programmes/hfe-for-patient-safety-level-1/
- **National Institute for Health and Care Excellence (NICE) - "Medicines Optimisation: The Safe and Effective Use of Medicines to Enable the Best Possible Outcomes"**
  https://www.nice.org.uk/guidance/ng5

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