Human factors or ergonomics and medication safety

Why do health care professionals prescribe, dispense and administer a penicillin to patients with a documented allergy to penicillin? Why do nurses or pharmacists pick the wrong product off the shelf and administer or dispense it in error? Health professionals do not intend to make these mistakes so what human factors should be taken into consideration in designing a system to prevent medication errors occurring?

Health professionals are human and share normal human limitations. Who has not left the lights on when they were sure they had switched them off, taken the route to the place they used to live instead of the house they moved into last week, or even put the sugar away in the fridge? Human limitations and human factors should be taken into account in the identification, assessment and management of medication safety risks, redesign of systems and analysis of medication-related incidents.

Human factors or ergonomics is a field of study in itself and cannot be covered in one short article. Further reading is provided at the end of this article.

Three key performance-influencing factors have been identified in the field of human factors:

- Job factors, for example, complexity, system/equipment interface (including look-alike, sound-like medicine names and packaging), communication, environment, divided attention.
- Person factors, for example, fatigue, stress, work overload, competence.
- Organisation factors, for example, peer pressure, staffing levels, work pressure, safety culture, level of supervision.

Example

In a highly stressful, chaotic and complex work environment, consider the number of errors that could occur when administering an oral liquid medicine to a patient. For example:

- the wrong patient is given the oral liquid medicine
- the wrong oral liquid medicine is given to the patient
- the wrong dose of the oral liquid medicine is given to the patient
- the wrong route is used and the oral liquid medicine is given to the patient intravenously.

Consider the number of steps required in the process of administering an oral liquid medicine, from identifying a dose is required to administering that dose to the patient by the oral route. How could human factors be applied to improve the system? When considering re-design of this system, what performance-influencing factors should be considered?

- Job factors – system/equipment interface, divided attention, time available, communication/supervision, procedures inadequate, preparation for task.
- Person factors – all the examples listed above could influence the outcome, particularly as a calculation is often required.
- Organisation factors – level of supervision, safety culture, staffing levels.

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One system change that can reduce the risk of the error occurring is the system/equipment interface. Using an intravenous syringe to draw up and administer an oral liquid medicine increases the risk of the medicine inadvertently being given intravenously. The effect of all the other human factors that could affect the outcome should still be considered but the risk is markedly reduced by making the equipment change. If oral syringes are always available and always used for drawing up and administering an oral liquid medicine, the risk of administering the liquid intravenously is reduced. Oral syringes do not have luer connectors and look very different to intravenous syringes.

This is only one example of using human factors in designing a safer medicine system. By considering human factors when designing medication systems and reviewing medication errors, we can improve the safety of systems and processes, and reduce risk for patients.

Further reading

What’s new?

One steps for medication safety

One steps are short tools [containing five or six questions], which can be used by clinicians to identify possible safety concerns with current practice and raise discussion about the need for practice change. The one steps published to date are on potassium chloride concentrated injection, insulin and warfarin. The latest is on warfarin in community pharmacy.

Each one step comes with background information and can be used as part of continuing professional development.

Opioids collaborative update

The safe use of opioids collaborative learning session one was held in February. The teams have been busy since then clarifying their aim statements, developing audit tools, identifying baseline harm levels and starting to test their proposed interventions using local rapid improvement cycles. The collaborative has issued the first edition of a regular newsletter.

Incidents and cautions

Decimal points and other error prone abbreviations in electronic systems

Reports to the Medication Error Reporting Programme (MERP) have highlighted the risk of patient harm when electronically generated prescriptions contain ambiguous abbreviations and dose designations.

Prescriptions that contain ‘naked’ decimals (eg, .5mg or .5mL) can result in 10-fold dosing errors. Without a leading zero, the decimal point is not easily recognised and can easily be read by dispensers and administrators as a whole number, even in electronic systems.

One advantage of electronic systems over handwritten communications is the elimination of error prone dose designations and abbreviations. The Health Quality & Safety Commission has published a list of error prone abbreviations and dose designations ‘not to use’ and recommends this list extends to electronic systems.

To make a report to MERP visit: https://nzphvc.otago.ac.nz/

Insulin 500 units/mL (Humulin R® U-500 units/mL)

One district health board has recently reported that this Section 29 product is being prescribed in New Zealand. Risks associated with the use of this strength of insulin have been identified internationally, for example:

- The patient says their insulin dose is 40 units, which is the measure on a 100 unit insulin syringe for their 200 unit dose of a 500 unit/mL insulin. They are prescribed 40 units of 500 unit/mL insulin when the dose should have been 200 units. Consequently the patient is under-dosed.
- The wrong dose is administered because of confusion between the strengths and using a 100 unit insulin syringe to administer a 500 unit/mL insulin.

The situation is being investigated further and will be reported on in Medication Safety Watch.

Upcoming events


Multi-dose insulin pen injectors are for single patient use and are not designed for sharing between multiple patients. Using a new needle will not prevent blood contamination of the cartridge.