Embracing the science of socio-technical design

Dr. Farah Magrabi

Senior Research Fellow

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NHMRC Centre of Research Excellence in Patient Safety

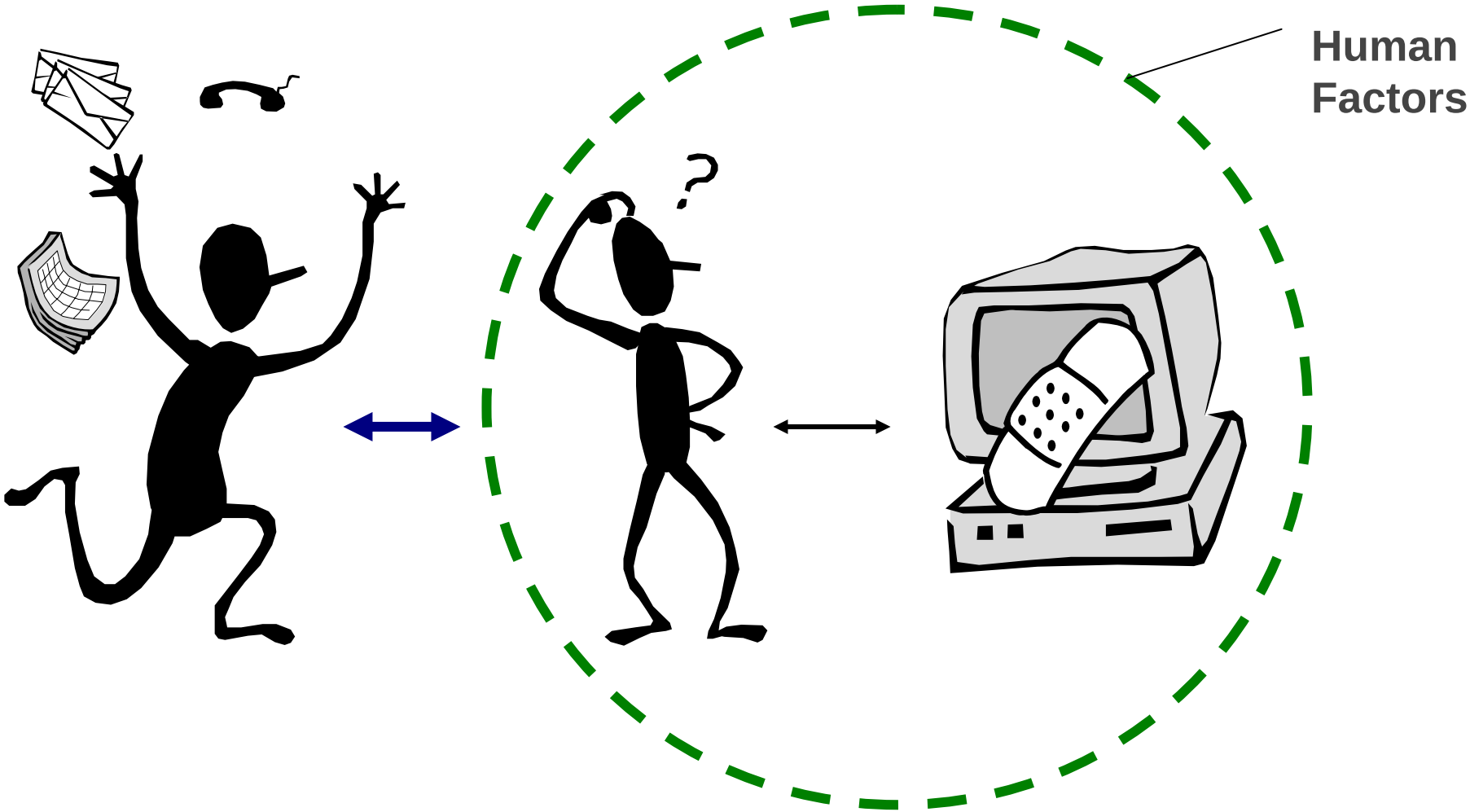
Background: ICT for patient safety

- Information and communication technologies (ICT) are a central component of efforts to improve health care quality and patient safety
- Computerised order entry and test result reporting a key safety intervention
  - medications, pathology, imaging, cardiology
- Promising results of improvements to patient safety, but there is a long way to go
- Evidence that ICT systems may also harm patients

Growing evidence that ICT contributes to clinical error

- US Pharmacopeia (2004): recorded a steady growth in ICT errors, **one** in **five** medication errors linked to computer use; 78% of computer errors linked to distractions
- Koppel et al. (2005): 22 types of ICT-related medication errors
- Han et al. (2005): mortality rate increased from 2.8% to 6.6% on introduction of computer order entry

Analysing socio-technical systems



Rule 1: Safety interventions have social consequences

- Doctor's use of a desktop computer resulted in:
  - shortened and delayed responses to patient
  - patients tried to judge when to talk based upon Drs interactions with the computer

  (Greatbatch et al. 1993)
- Computerised physician order entry changed communication patterns and practices
  - reduced staff face-to-face interactions for patient care
  - miscommunication, delays in initiation and execution of orders

  (Campbell et al. 2007)
- Bar coded medications administration reduced co-ordination of care (Patterson et al. 2002)

after Coiera E. **Four rules for the reinvention of health care** BMJ, 2004. **328**

Rule 2: Social systems have safety consequences

- Clinical leadership is key to successful implementation of ICT to improve patient safety
- Uptake of online evidence systems in NSW hospitals linked to:
  - local champions
  - innovative teams
  - culture supporting evidence-based practice

  Gosling et al. (2003)
- New safety interventions more likely to work in organisations with an existing safety culture

after Coiera (2004)

Rule 3: We don't design safety interventions, we design socio-technical systems

- Patient safety interventions at the point of care
  - electronic prescribing
  - decision support
- Medication **ordering** errors linked to 56% of ADEs and potential ADEs (Bates et al. 1995)
- Some desirable attributes
  - support collaborative decision-making
  - facilitate Drs' interactions with pharmacy
  - location of computers relative to patient and clinical team
  - allow safe recovery from interruptions
- We must focus design on preserving and improving the most safety-critical interactions

after Coiera (2004)

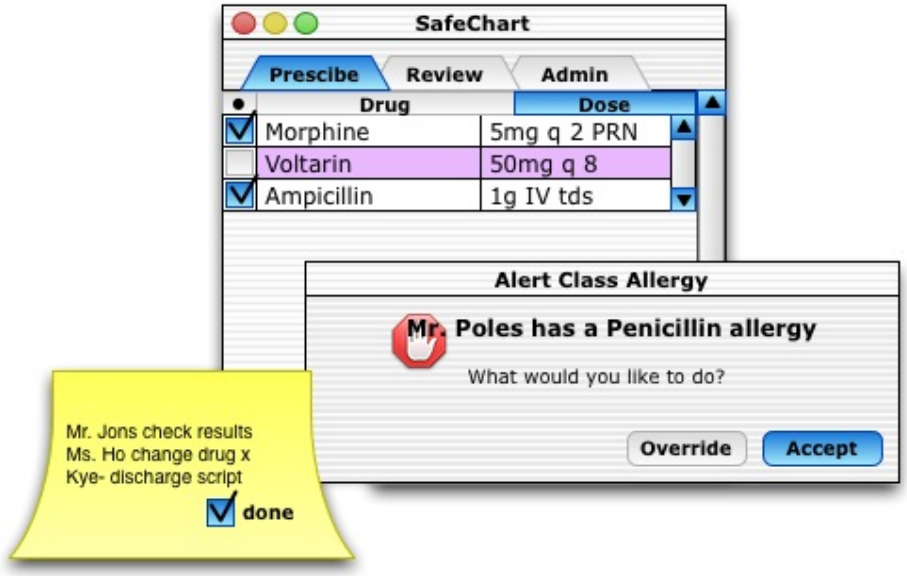
Rule 4: To design socio-technical systems we must understand how people and safety interventions interact

- Clinical task and complexity
- Human skills and cognitive limits
  - time
  - workload
- Environment
- Work process
- Organisational policy and safety culture

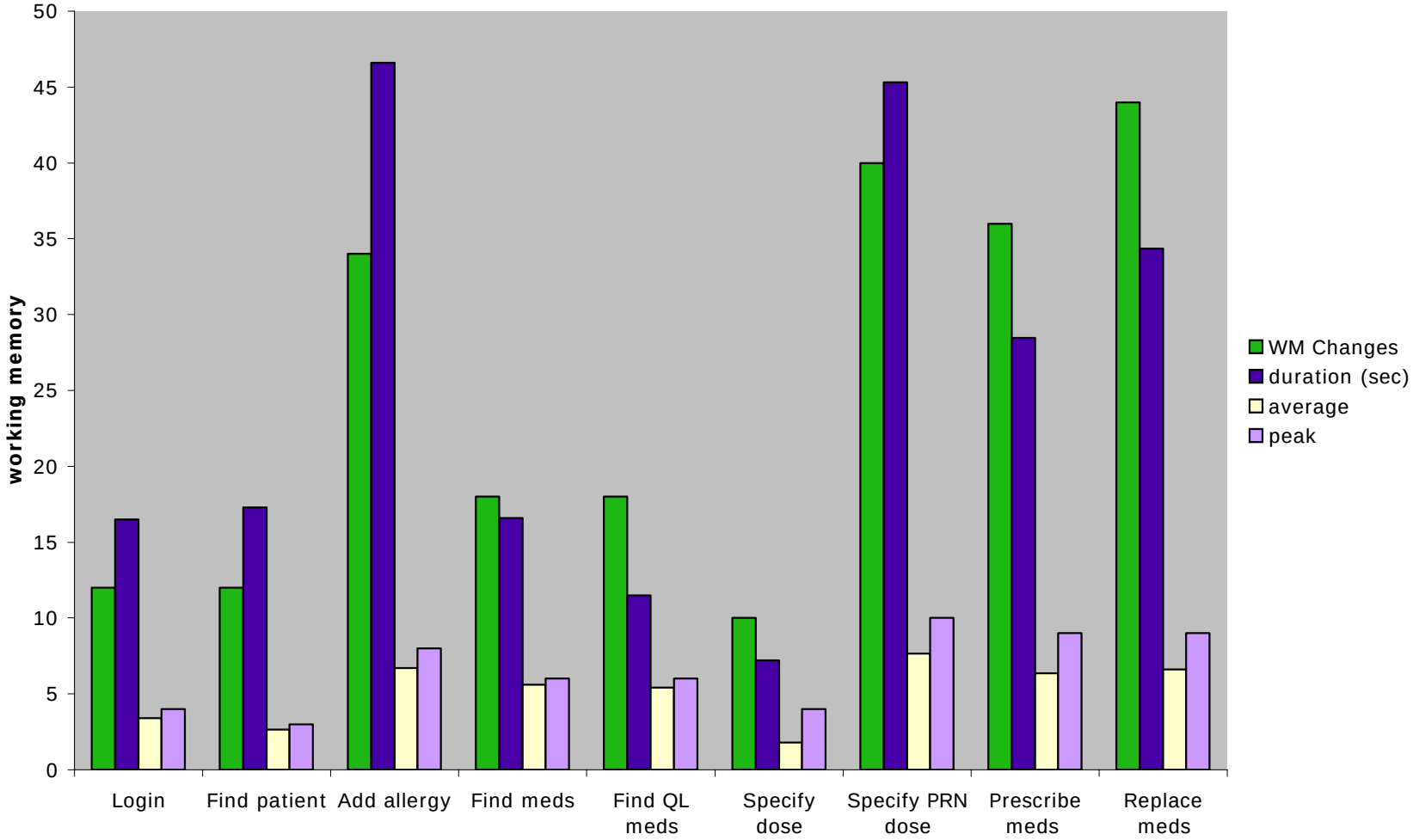
after Coiera (2004)

Example: modelling user interactions to add a new medication

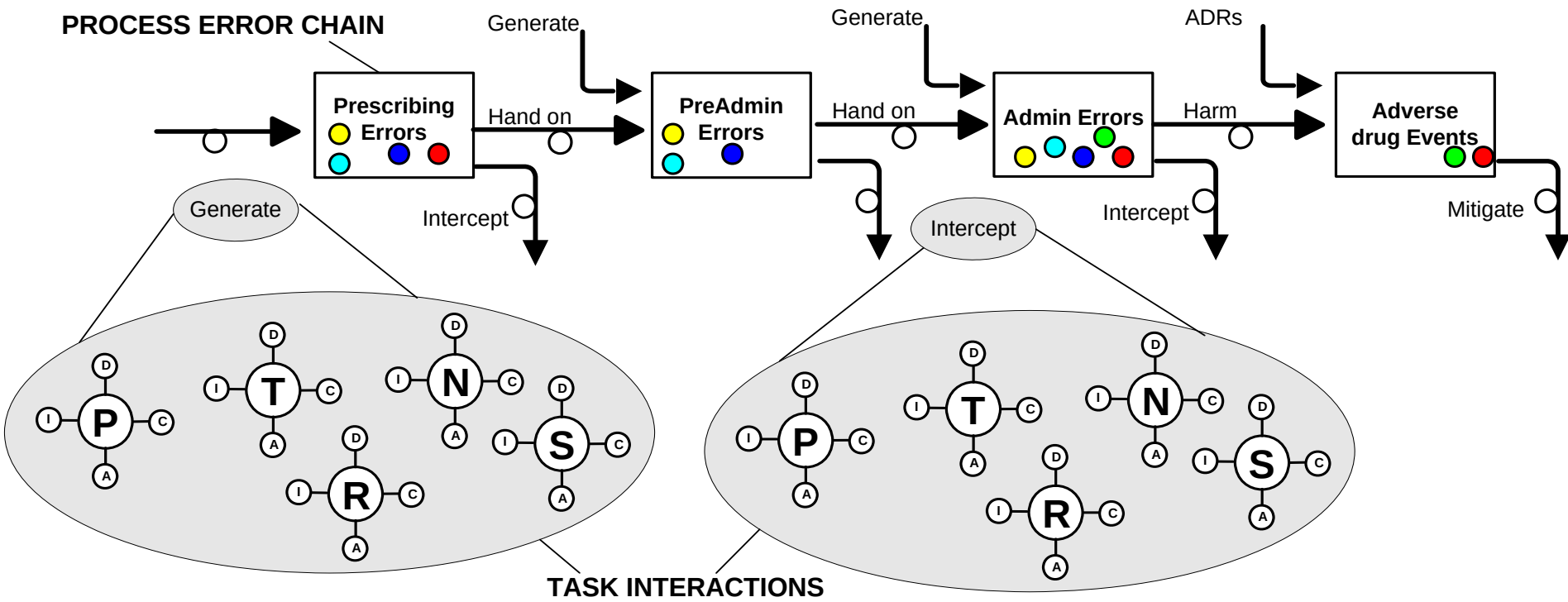
>text input name >hit enter or click on search button
>**select** name from list
>**select** form from list
>**select** frequency from drop down menu, PRN
>text enter minimum dosage interval
>**select** interval unit from drop down list
>text enter maximum dosage
>**select** dose/mg from drop down list
>text enter maximum dosage interval
>**select** interval unit from drop down list
>click on continue



Use of working memory in typical prescribing task interactions



Prescribing process and task interactions



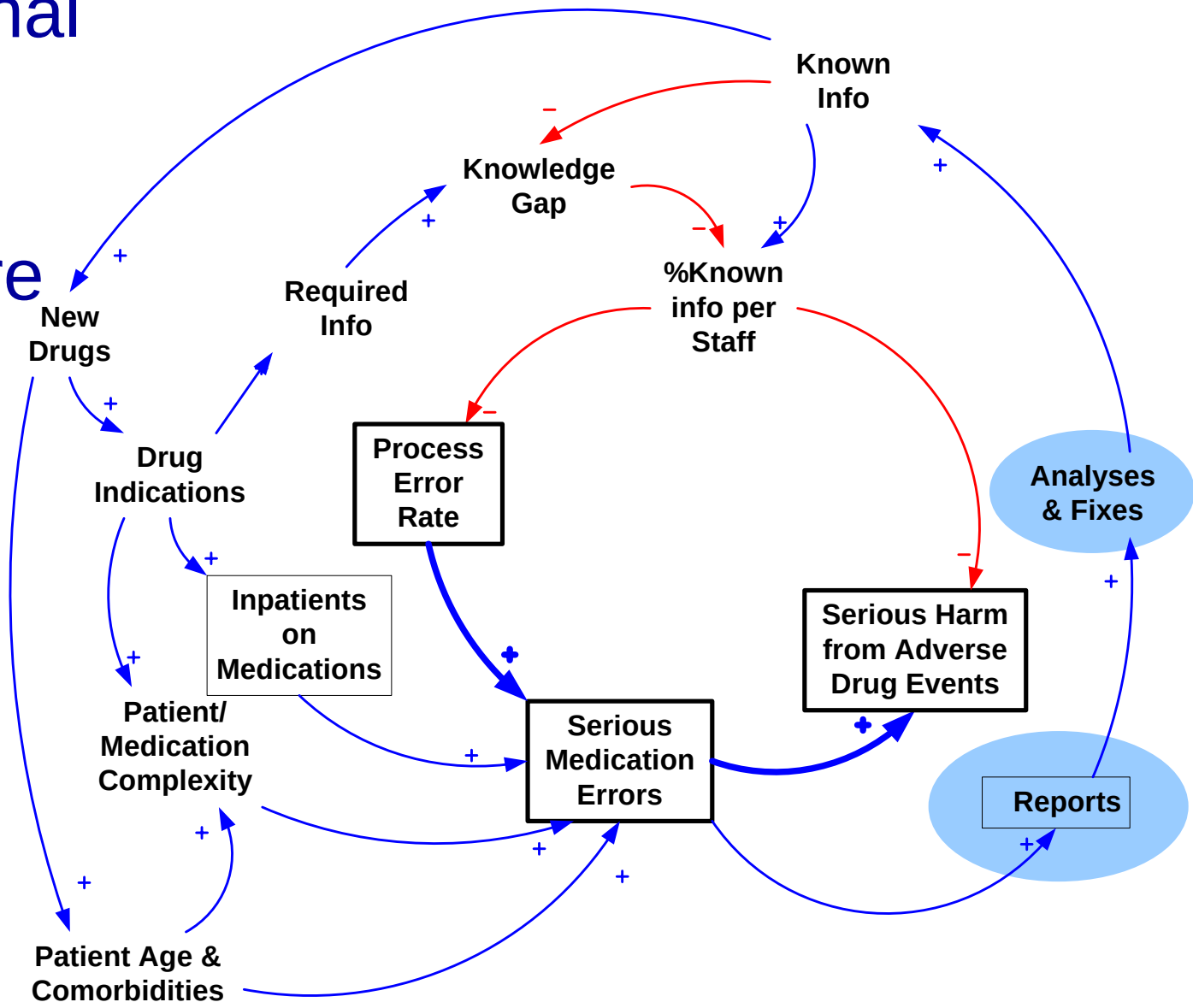
Agents

P- pharmacist
N- nurse
R- resident
S- specialist
T- patient

Roles

I- inform
A- act
D- decide
C- communicate

Organisational policy and safety culture



Embracing the science of socio-technical design

1. Patient safety interventions have ***social*** consequences
2. Social systems have ***safety*** consequences
3. We don't design safety interventions, we design socio-technical systems
4. To design socio-technical systems we must understand how people and safety interventions interact

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Dr. Farah Magrabi
f.magrabi@unsw.edu.au

Clinical Systems Safety Engineering @ UNSW

- To understand how decision support may cause harm
- To develop design principles and methods that ensure safety
- To drive safety standards and accreditation
- To actually design exemplar safer systems which minimise the impact of human error and system failures.
- To explore specific theoretical approaches from novel ***accident models*** to ***cognitive load theory*** in support of this work.