Human Factors in Healthcare

A perspective on challenges and opportunities

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Digital Health Human Factors Group

We apply HF methods and approaches to evaluate and optimise health technologies to support healthcare work and improve patient safety

We are embedded in a larger research theme, Biomedical Informatics and Digital Health, focused on developing, applying, implementing and evaluating informatics tools to support human health

DHHF main research areas

- Understanding and improving the fit between clinicians and health technologies
- Electronic medication management systems, electronic prescribing
- Computerised decision support
- Safety of health technology
- Unintended consequences of health technology use and implementation
- Evaluation and implementation of health technology

DHHF main impacts (1 Prof, 1 RF, 2 RAs, 5 HDRs)

- About 10 projects running at a time (3-5 funded)
- Knowledge generation: about 20 papers/year
- Partnerships: all projects are partnerships
- Translation:
  - Redesign (or design) of technologies
  - Findings inform technology selection/adoption
  - Changes to policies and procedures
  - Findings incorporated into guidelines

How I did I get here?

Undergraduate degree in Psychology (HFE touched on briefly)

PhD in Psychology (habit formation)

Post-doc in railway safety: train driver errors (my entry into HFE)

Post-doc in patient safety: medication errors

Research-only academic for 13 years (up to A/Prof)

Prof in HF (teaching and research)

Lots of challenges with HFE integration in healthcare (and health tech specifically)

- Misunderstanding of HFE as a discipline
- HFE workforce (it is lonely in health so quite a few people jump ship)
- Hard to quantify (and cost) value of HFE, so hard to include in business cases
- Grant funding for applied HFE research
- System design and redesign is challenging (often not possible)

My first impressions of HFE in Healthcare

I started a post-doctoral position in 2009, and my supervisor was a clinician at the hospital

I sat in the basement of the hospital for 7 years

At the time, the hospital were leaders in implementation of electronic medication management (the 1st to do this in NSW) and my supervisor (clinical pharmacologist) was a clinician champion

Challenge: Poor awareness and understanding of HFE

No-one knew was HFE was

If they had heard of HFE, they assumed Human Factors were factors related to people (decision-making, errors, violations)

Even the 'Patient Safety and Quality' committee did not really understand what HFE was

What did I do?

I ran research projects at the hospital
I tried to be **visible**: on the wards for data collection, tried to meet as many people as possible
I tried to **embed** myself in the organisation: Attend all meetings, workshops, seminars (even those I didn't understand)

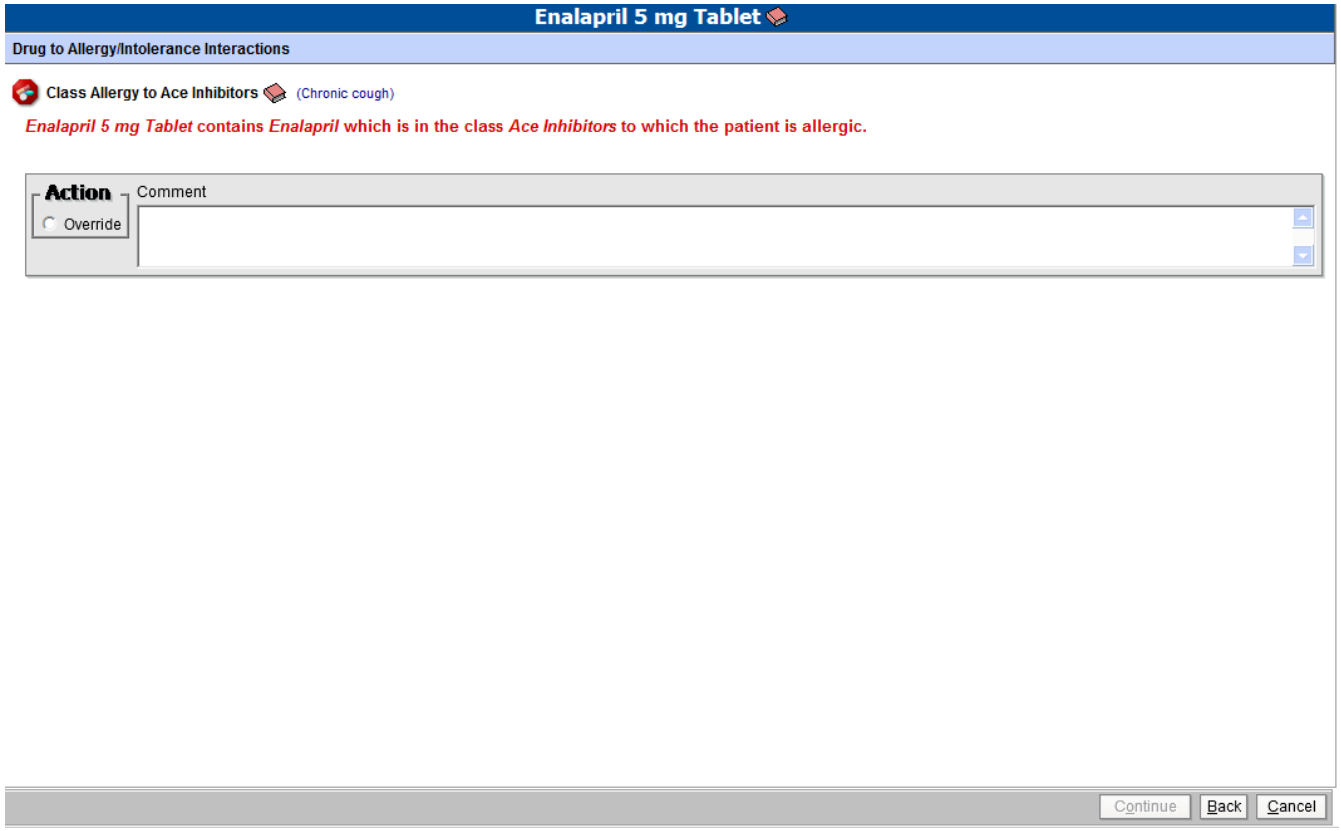
My supervisor was popular and supportive, which helped ☺

Over time, I learned how to explain HFE simply to healthcare folks
Soon, people were coming to me with questions and problems that they needed HF expertise on

Research projects focus(ed) on

- Computerised alerts
- Decision support for antimicrobial prescribing
- Electronic information sources
- Advanced dosing decision support
- Hospital-wide journey board
- Risk assessment tool for venous thromboembolism
- Error prone abbreviations
- Doctors' work practices after-hours and on weekends
- Mobile devices for shared decision making
- Mobile app for gout management

Example: Program of work on computerised alerts



Main methods used

Observations of work as done – how doctors interacted with alerts and used them in practice in different contexts

Interviews - with prescribers of different levels, different experiences etc.

Chart audits – to determine alert burden to users

Surveys/Delphi studies – to try and reach consensus on alerts to keep in and take out

Key findings

1. Doctors were being over-alerted and experiencing alert fatigue
2. Alerts were typically ignored by users
3. Alerts were used differently in different contexts by different users
4. Alert design was sub-optimal

Most useful method: work observations (revealed so much!)

Alert fatigue: It pops up so often which can be a very bad thing because you're dismissing it so often that you develop this sort of mechanism so it can be bad in a sense that sometimes you might miss some important things

Wrong time: The decision to prescribe something is based on your clinical knowledge…by the time you type it in and prescribe it you've already made that decision

Poor design: I guess less words and more point forms would be easier because then we wouldn't have to scroll through paragraphs and sentences of text

What changed as a result of the research?

Many alerts removed: **reduced alert burden by >50%**

Although limited changes possible to alert design (without vendor input) all locally developed alerts were re-designed

Lots of presentations at national conferences and forums

→ Good alert design principles now being used by lots of hospitals and districts in Australia, and appear as an appendix in NSW Health's clinical decision support guideline

Outside of the hospital, I noticed HFE getting a bit more attention

NSW Health pillars (Clinical Excellence Commission and eHealth NSW recruiting HFE folks)

This was exciting ☺

I saw this as an opportunity to establish partnerships!

Example: Partnership with eHealth NSW

NSW Health's digital centre for excellence

Plan, implement and support ICT and digital capabilities across NSW (our largest state)

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How this partnership came about:

I approached eHealth NSW with a grant idea and we entered into a Partnership grant together (still ongoing)

[To secure funding, I combine HFE with large scale evaluation of health technologies]

How this ongoing partnership works

I approach eHealth NSW with new partnership projects
I submit EOIs for all eHealth NSW's requests for work

I give my time in-kind for some things, and they do the same for me

I have worked hard on developing a reputation with them as a good collaborator, with valuable HF expertise

Research projects focus(ed) on

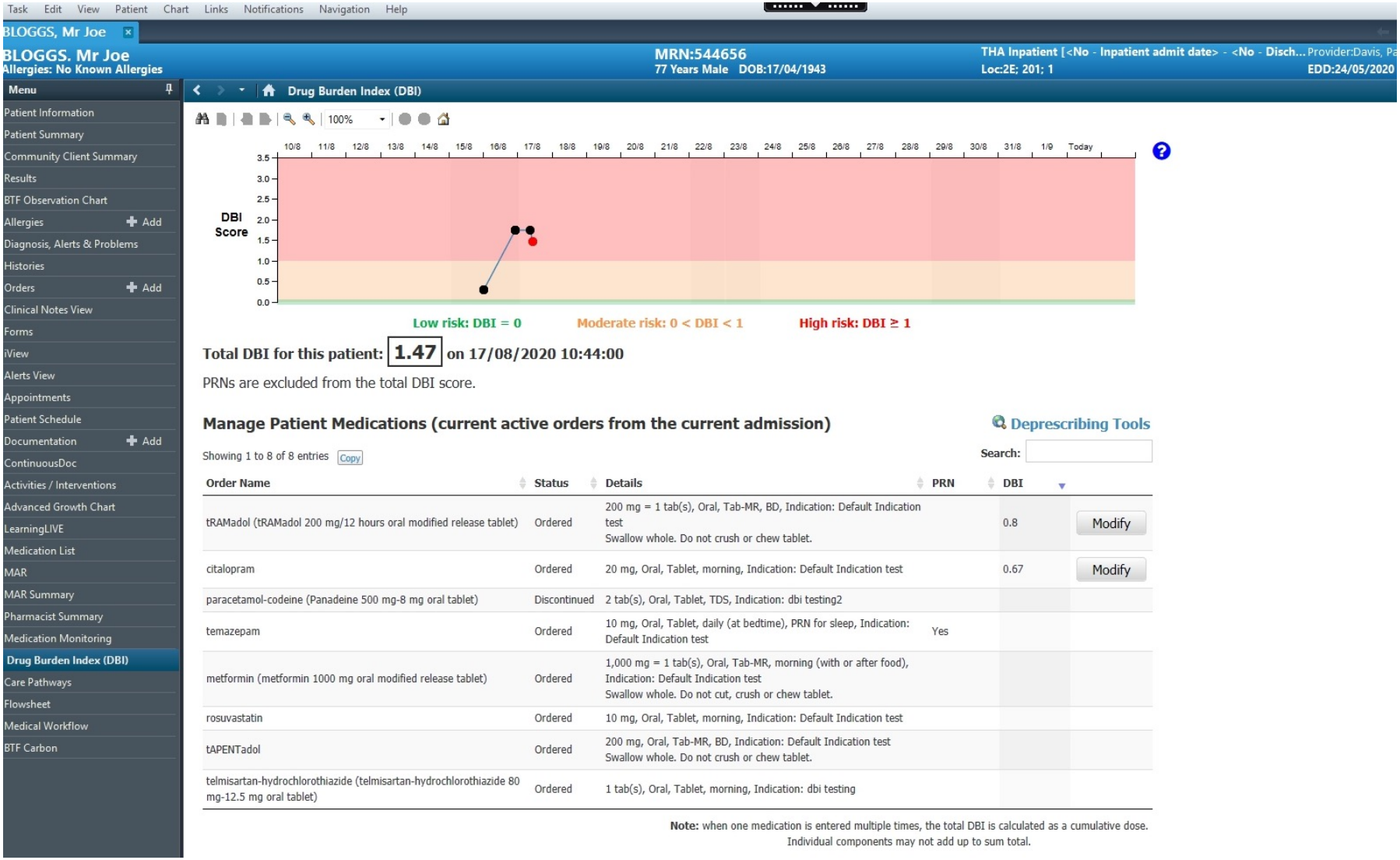
- Computerised alerts
- Electronic medication management in pediatrics
- Electronic medication management in oncology
- Reducing polypharmacy
- Transfer of care between ICU and hospital wards
- Human Factors methods for the design of electronic medication management systems (PhD project)
- Prescription drug monitoring systems (PhD project)

Example: Design and implementation of a CDS to support deprescribing

Project led by Prof Sarah Hilmer

My team led design of the tool

(work observations, > 150 interviews, co-design workshops, usability testing)


Task Edit View Patient Chart Links Notifications Navigation Help
BLOGGS, Mr Joe
BLOGGS. Mr Joe
Allergies: No Known Allergies
MRN:544656
77 Years Male DOB:17/04/1943
THA Inpatient [<No - Inpatient admit date> - <No - Disch... Provider:Davis, Pa
Loc:2E; 201; 1
EDD:24/05/2020
Menu
Patient Information
Patient Summary
Community Client Summary
Results
BTF Observation Chart
Allergies Add
Diagnosis, Alerts & Problems
Histories
Orders Add
Clinical Notes View
Forms
iView
Alerts View
Appointments
Patient Schedule
Documentation Add
ContinuousDoc
Activities / Interventions
Advanced Growth Chart
LearningLIVE
Medication List
MAR
MAR Summary
Pharmacist Summary
Medication Monitoring
Drug Burden Index (DBI)
Care Pathways
Flowsheet
Medical Workflow
BTF Carbon
Drug Burden Index (DBI)
100%
10/8 11/8 12/8 13/8 14/8 15/8 16/8 17/8 18/8 19/8 20/8 21/8 22/8 23/8 24/8 25/8 26/8 27/8 28/8 29/8 30/8 31/8 1/9 Today
DBI Score
3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
Low risk: DBI = 0
Moderate risk: 0 < DBI < 1
High risk: DBI ≥ 1
Total DBI for this patient: 1.47 on 17/08/2020 10:44:00
PRNs are excluded from the total DBI score.
Manage Patient Medications (current active orders from the current admission)
Deprescribing Tools
Showing 1 to 8 of 8 entries Copy
Search:
Order Name
Status
Details
PRN
DBI
tRAMadol (tRAMadol 200 mg/12 hours oral modified release tablet)
Ordered
200 mg = 1 tab(s), Oral, Tab-MR, BD, Indication: Default Indication test
Swallow whole. Do not crush or chew tablet.
0.8
Modify
citalopram
Ordered
20 mg, Oral, Tablet, morning, Indication: Default Indication test
0.67
Modify
paracetamol-codeine (Panadeine 500 mg-8 mg oral tablet)
Discontinued
2 tab(s), Oral, Tablet, TDS, Indication: dbi testing2
temazepam
Ordered
10 mg, Oral, Tablet, daily (at bedtime), PRN for sleep, Indication: Default Indication test
Yes
metformin (metformin 1000 mg oral modified release tablet)
Ordered
1,000 mg = 1 tab(s), Oral, Tab-MR, morning (with or after food), Indication: Default Indication test
Swallow whole. Do not cut, crush or chew tablet.
rosuvastatin
Ordered
10 mg, Oral, Tablet, morning, Indication: Default Indication test
tAPENTadol
Ordered
200 mg, Oral, Tab-MR, BD, Indication: Default Indication test
Swallow whole. Do not crush or chew tablet.
telmisartan-hydrochlorothiazide (telmisartan-hydrochlorothiazide 80 mg-12.5 mg oral tablet)
Ordered
1 tab(s), Oral, Tablet, morning, Indication: dbi testing
Note: when one medication is entered multiple times, the total DBI is calculated as a cumulative dose.
Individual components may not add up to sum total.

What changed as a result of the research?

Tool embedded in EMR in 2 LHDs

Currently being tested in a large stepped wedge trial

Statewide roll out (hopefully)

Challenge: Technology changes (design and redesign)

Very limited design/redesign possible at the local level

Our EMR systems are US off-the-shelf products

Partnership with Sydney Local Health District

Large health district in Sydney: 16,000 staff responsible for >740,000 people living in the district boundaries

6 hospitals, lots of community care and a virtual hospital

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How this partnership came about:

SLHD approached me about partnering on research projects, and I approached them about partnering on others

How this ongoing partnership works

We meet regularly to discuss projects and needs
We submit lots of grant applications together

I give my time in-kind for some things, and they do the same for me

I have worked hard on developing a reputation with them as a good collaborator, with valuable HF expertise

Research projects focus(ed) on

- Decision support in virtual care
- Remote monitoring devices in virtual care
- Hands-free communication system
- Nursing documentation in the EMR
- Patient booking and navigation system
- New errors associated with use of EMM (PhD project)
- Digital health to support antimicrobial stewardship (PhD project)

Example: Removing unnecessary data entry fields in the EMR

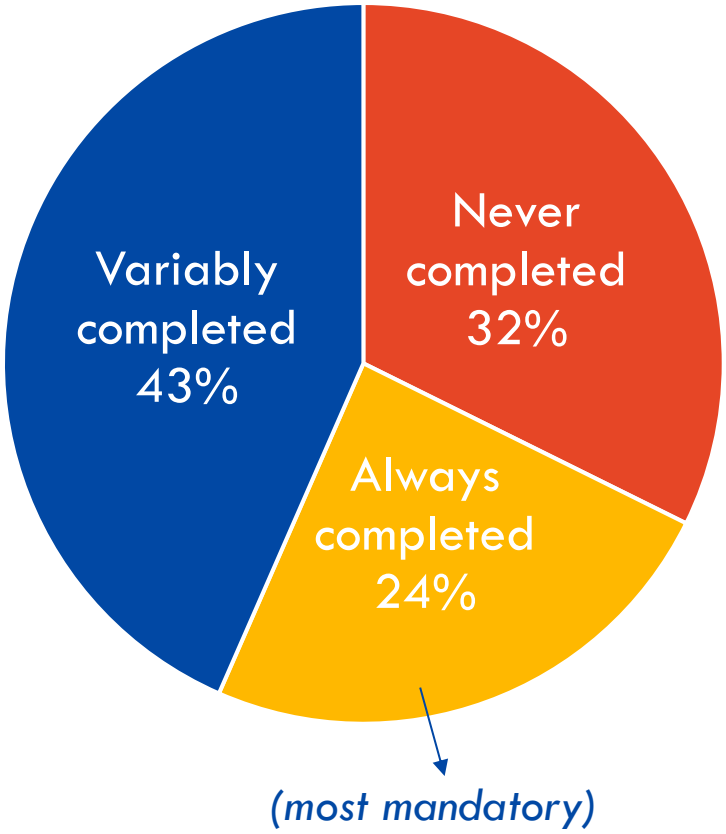
Main goal – to identify data elements that could be moved or removed from the nursing admission form

What did we do?

Review of data	Reviewed admission form compliance and data element utilisation using EMR data
Review of practice	Reviewed current admission practice and workflow via consultation with nurses
Review of policy	Reviewed evidence and policy relevant to nursing admission and documentation
Workshop	Workshop with nursing and informatics teams to rationalise data elements to be retained and understand impacts of moving/removing data elements
Post workshop debrief	Consolidation of findings from all phases to arrive at essential data elements to maintain in the EMR

Key findings

Review of data elements



Review of practice

Repetition of information, duplication of tasks

Tick-box exercise

"something that they have to do more than something they value"

What was the overall outcome?

Only **9%** of data elements should be maintained in the admission form

57% could be removed due to low utilisation or duplication in other EMR sections

27% could be moved and collected through existing sections of the EMR

Project highlighted that systems should be designed with the *objective* in mind

The main objective of the admission form is care planning, so all data elements not needed for care planning should be removed

Unnecessary documentation

User frustration

Negative perceptions of the EMR system

Workarounds

What changed as a result of the research?

Hospital moving to a new EMR so no changes made to the admission form

BUT

Research is frequently used as rationale for not adding more data fields to the form

Reflections: the value of breaking down barriers between HFE and Medicine and Health

(I'm not giving up)

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- HFE allows you to uncover issues that may not be known to executives/decision makers
- HFE (especially observation) allows you to uncover issues that may not even be known to end-users
- Generate evidence that is robust and 'scientific'
- **Increase awareness of HFE in healthcare** (what is it and its value)
- HFE is inter-disciplinary in itself, so provides an opportunity to **apply learnings across domains** (e.g. from transport to health). Particularly important for health, which is **lagging behind** others in its adoption of HFE

HFE advocacy

- Chair of the **International Ergonomics Association (IEA**) Healthcare Ergonomics Technical Committee
- Committee member of the Healthcare Ergonomics SIG of **HFESA** (Chair 2015-19)
- HFESA's patient safety representative for **WHO**
- Co-chair of **International Medical Informatics Association (IMIA**) Working group on Organizational and Social Issues
- Co-chair of 'Human, Organisational and Social Aspects' track of MedInfo (Bi-annual **World Congress on Medical and Health Informatics**)
- NSW Clinical Excellence Commission's Human Factors Advisory Group

A big thanks to everyone for their help

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Thank you

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(happy to share any papers)

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