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Delivering the right information to the right person at the right time to facilitate deprescribing in hospital: A mixed-methods multi-site study to inform decision support design

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Manuscripts

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3 **Delivering the right information to the right person at the right time to facilitate**
4 **deprescribing in hospital: A mixed-methods multi-site study to inform decision**
5 **support design**
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Abstract

Objectives: To inform the design of electronic decision support (EDS) to facilitate deprescribing in hospitals we set out to 1) explore the current processes of in-hospital medicines review, deprescribing and communication of deprescribing decisions with the patient's general practitioner (GP), 2) identify barriers to undertaking these tasks, and 3) determine user preferences for EDS.

Design: Multi-method, multi-site study comprising observations, semi-structured interviews and focus groups.

Setting: General medicine, geriatric medicine and rehabilitation wards at six hospitals in two local health districts in Sydney, Australia, and primary care practices in one primary healthcare district in Sydney, Australia.

Participants: 149 participants took part in observations, interviews and focus groups, including 68 hospital doctors, 14 nurses, 55 pharmacists and 12 GPs.

Main outcome measures: Observational data on who was involved in medicines review and deprescribing, when medicines review took place, and what artifacts (e.g. forms) were used. Participants' reported perceptions of medicines review, polypharmacy, and deprescribing, and preferences for EDS.

Results: Deprescribing, undertaken during medicines review, was typically performed by a junior doctor, following a decision to deprescribe by a senior doctor. Key barriers to deprescribing included a perception that deprescribing was not the responsibility of hospital doctors, a lack of confidence among junior doctors and pharmacists in broaching this topic with senior doctors, and a lack of patient engagement in the deprescribing process. In designing EDS, the tools, likely to be used by junior doctors, pharmacists and nurses, should be available throughout the hospitalisation and should comprise non-interruptive evidence-based guidance on why and how to deprescribe.

Conclusions: Deprescribing decisions are complex and influenced by multiple factors. The implementation of EDS alone is unlikely to address all barriers identified. To achieve sustained improvements in monitoring of polypharmacy and subsequent deprescribing, a multi-faceted intervention is needed.

ARTICLE SUMMARY

Strengths and limitations of this study

- This multi-method, multi-site study comprised an in-depth investigation of medicines review and deprescribing with a large number of multi-disciplinary clinicians.
- By complementing interviews with in situ observation, we were able to validate some participants' perceptions with objective data
- Our results are primarily drawn from interviews and may be subject to biases associated with self-report.
- The perceptions and practices described may not be generalisable to other clinical services or different settings.

INTRODUCTION

Potentially inappropriate polypharmacy occurs in approximately half of older hospitalised patients internationally and is not usually addressed during routine hospital care.[1, 2] Deprescribing, the cessation of a potentially inappropriate medication, supervised by a health care professional with the goal of managing polypharmacy and improving health outcomes,[3] is gaining momentum internationally.[3-5] Addressing inappropriate polypharmacy in older inpatients is essential to meet the Third World Health Organization (WHO) Global Patient Safety Challenge: 'Medication Without Harm', which targets high risk situations, polypharmacy and transitions of care, aiming to reduce avoidable harm related to medications by 50% over five years.[6]

As hospitals are increasingly transitioning from paper-based medication charts to electronic order entry systems, an opportunity exists to integrate decision support and guidance for medication review and deprescribing into these systems. There is now good evidence to show that when well-designed and targeted, electronic decision support (EDS) can have significant impacts on care outcomes.[7-9] This is applicable to decision support targeting potentially inappropriate prescribing, with two recent reviews determining that computerised interventions are effective in reducing potentially inappropriate prescribing in hospitalised patients.[10, 11] However, there are also an increasing number of studies demonstrating that decision support is ignored or not used by clinicians.[12, 13] In fact, both above-mentioned reviews highlighted this problem and stressed the importance of working with users to ensure decision support is relevant and aligns well with clinician workflow.[10, 11]

EDS can facilitate decision making if it provides the right information at the right time to the right person.[9] However, determining the right information, and identifying the right time and person to target is challenging. The aim of this study was to explore the current processes of in-hospital medicines review, deprescribing and communication of deprescribing with the patient's general practitioner (GP). In particular, we aimed to identify barriers to undertaking these tasks, and to explore user preferences for decision support, in order to inform the design of electronic decision support to support these key processes.

METHOD

A multi-methods approach was used comprising observations of clinicians (doctors and pharmacists), and interviews and focus groups with clinicians (hospital doctors, nurses, pharmacists and GPs).

Setting and participants

This study was undertaken at six hospitals in two local health districts, and in primary care practices in one primary healthcare district in Sydney, Australia. See Supplementary file for additional information.

Table 1 outlines details of the study sites at the time of data collection and the participants who took part. All hospitals used a commercial clinical information system, PowerChart® (current code level 2015, Cerner Corporation, Kansas City, MO <https://www.cerner.com>), but only one hospital used electronic medication management at the time of data collection.

Table 1. Study site information and details of interviews, focus groups and observations undertaken.

	Type of hospital, approximate number of beds	Clinical information systems, paper systems	Number of participants interviewed	Approximate hours of observation	Number of participants observed
Site A	Tertiary referral, >500	Electronic ordering for tests and imaging Electronic progress notes Paper-based medication charts	10 Doctors 8 Nurses 21 Pharmacists	17 hours	13 Doctors 1 Pharmacist
Site B	Tertiary referral and rehabilitation, >500	Electronic ordering for tests and imaging Electronic progress notes	20 Doctors 15 Pharmacists	21 hours	16 Doctors 2 Pharmacists

		Electronic medication charts			
Site C	Acute district, 100-199	Electronic ordering for tests and imaging Electronic progress notes Paper-based medication charts	-	6 hours	2 Doctors
Site D	Geriatric and rehabilitation, 50-99	Electronic ordering for tests and imaging Paper-based progress notes Paper-based medication charts	1 Pharmacist	7.5 hours	8 Doctors 1 Pharmacist
Site E	Acute district and rehabilitation, 100-199	Electronic ordering for tests and imaging Paper-based progress notes Paper-based medication charts	11 Pharmacists	-	-
Site F	Acute district and	Electronic ordering for	11 Doctors 6 Nurses	-	-

	rehabilitation, 200-500	tests and imaging Paper-based progress notes Paper-based medication charts	5 Pharmacists		
Primary care			12 GPs	-	-

Note: Some participants took part in both observations and interviews.

In total, 149 clinicians participated in the study across six hospitals and the community (68 hospital doctors, 55 pharmacists, 14 nurses and 12 GPs). The study included hospital-based doctors, nurses and pharmacists who work in geriatric medicine, general medicine and rehabilitation wards at each site. Approximately 52 hours of observation were undertaken across four hospitals (Table 1).

Data collection

Observations of hospital clinicians

Researchers (two pharmacists and a geriatrician) shadowed hospital clinicians as they completed routine tasks related to medicines review and collected detailed hand-written notes on the following: who was involved in medicines review and deprescribing, where medicines review took place, and what artifacts (e.g. forms, electronic systems) were used. Researchers also classified the type of medicines review that they observed into either 1) an initial review at admission to hospital, 2) a review during a patient’s stay (i.e. follow-up), or 3) a review at discharge from hospital.

Interviews and focus groups with hospital-based clinicians and general practitioners

Semi-structured interviews and focus groups with hospital clinicians focused on four main areas: the current process of medicines review, polypharmacy, deprescribing, and preferences for EDS. Interview questions are presented in the Supplementary file. Semi-structured interviews and focus group with GPs in primary care practices focused on four main areas: perceptions of the current process of medicines review in hospital, polypharmacy, deprescribing, and preferences for communication of in-

hospital deprescribing on discharge to improve continuity of medication management after review in hospital. Interview questions are presented in the Supplementary file.

Data analysis

Hand-written notes were taken during observations and were collated to enable identification of key elements of medicines review and deprescribing.

Interviews and focus groups were audio-recorded, transcribed verbatim and de-identified. An iterative general inductive approach was used for analysis.[14] Three researchers independently reviewed de-identified transcripts and coded the data. The four focus areas (medicines review, polypharmacy, deprescribing and EDS) guided initial coding of the transcripts. Multidisciplinary researchers, including clinicians, EDS specialists and researchers with expertise in qualitative research, met periodically throughout data collection to discuss and compare identified themes. Any disagreements in themes were discussed until a consensus was reached.

Public and patient involvement statement

No patients or the public were involved in any stage of the research process for this study.

Ethics approval

Ethics approval was obtained from Northern Sydney Local Health District Human Research Ethics Committee (LNR/17/HAWKE/138), with site specific approval obtained from each participating hospital. Written informed consent was obtained from all participants in the study.

RESULTS

Medicines review – the current process

In total, 117 instances of medicines review were observed across four hospitals. Table 2 summarises the data collected from observations.

Table 2. Characteristics of medicines reviews and episodes of deprescribing observed during 52 hours of observations across four Sydney hospitals.

		Site A	Site B	Site C	Site D
		Number of times observed			

Medicine reviews		39	45	12	21
Type of medicine review	Initial review	5	9	1	3
	Follow-up	23	30	5	14
	Discharge	11	6	6	4
Location of medicine review*	Hallway	16	19	9	7
	Patient bedside	19	31	8	10
	Other (e.g. office)	7	6	2	5
Type of device used*	COW	26	37	10	5
	Computer at JMO/registrar workstation	3	3	2	2
	Computer at pharmacy workstation	-	3	-	1
Medicine reviews where deprescribing occurred		15 (38%)	24 (53%)	4 (33%)	7 (33%)
In deprescribing cases:					
Provider who requested the change to a medication	Consultant	11	11	1	6
	Registrar	3	10	3	1
	JMO	-	3	-	-
	Pharmacist	1	-	-	-

Provider who changed the medication	Consultant	-	2	-	-
	Registrar	6	7	4	5
	JMO	9	15	-	2
Artefacts accessed* <i>Italicised artefacts are those accessed via the electronic medical record</i>	Paper medication chart	11	-	4	6
	Patient list	4	12	1	1
	Observations	-	-	2	1
	Progress notes	13	14	3	-
	Test results	8	18	3	2
	Medication list	-	8	-	-
	MAR/MAR Summary	-	20	-	-
Orders (medications, pathology)	Orders (medications, pathology)	6	5	2	-
	Observations	4	6	-	-

*Numbers are greater than total events observed as single events could have included multiple locations, devices and artefacts

Note: COW = Computer on wheels; MAR = Medication Administration Record; JMO = Junior medical officer

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5 During interviews and focus groups with hospital staff, participants demonstrated an
6 inconsistent understanding of what medicines review was and of what it involved.
7 Participants spoke about obtaining a best possible medication history, undertaking
8 medication reconciliation, and reviewing inpatient medication charts.
9

10
11
12 A pharmacist said: *By med review, are you talking about the first med review, when*
13 *you're doing the history and the whole full thing or are you talking about a daily or*
14 *every two days, whatever you might do, have a new order, check the new antibiotic*
15 *and see if it's appropriate, are there any interactions? That also can be called a med*
16 *review. P1013*
17
18
19

20
21 And a doctor: *I think it's a little undefined in terms of who does it, and depending on*
22 *the time of the day, even the day of the week, you'll have different people doing it.*
23
24 *D4004*
25
26
27

28 Most participants explained that a medicines review was undertaken within a few
29 days of admission and triggered at certain time points in a patient's journey, such as
30 transfer between settings (e.g. emergency department to the ward) and at discharge
31 from hospital. This is consistent with what we observed on wards (see Table 2).
32 During discussions with staff it became apparent that medicines review was
33 perceived to be the role of doctors, both senior and junior, and of pharmacists.
34
35
36

37 Participants reported that common triggers for medicines review were patient factors
38 (e.g. age, comorbidities), medication-related factors (e.g. high risk medicines) and
39 requests from other healthcare providers.
40
41
42

43 The information that participants reported accessing during medicines review
44 depended on their understanding of the process. For example, participants noted
45 that key information sources for medication reconciliation were GPs, patients,
46 families, residential aged care facilities, and pharmacies. Participants who viewed
47 medicines review as a review of the inpatient medication chart described accessing
48 inpatient notes, medications and pathology results. This is consistent with what we
49 observed (Table 2).
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54 **Barriers to medicines review**

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56 The main barrier reported to impact on medicines review was limited time.
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3 A pharmacist said: *Obviously, ideally, you would want to do that medication review*
4 *after you do that history taking. But then, you have so many patients that come in*
5 *that all need history taking... we just don't have time. P2004*
6
7

8 Other reported barriers were short length of stay (preventing a detailed review), and
9 missing or unreliable information in clinical information systems.
10

11 **Awareness and understanding of polypharmacy**

12 Participants appeared to have a strong understanding of polypharmacy, with many
13 emphasising that it is not simply the number of medications that a patient is taking,
14 but also whether the medications are needed. Clinicians discussed the concept of
15 inappropriate polypharmacy for the individual patient.
16
17

18 A doctor said: *I think of polypharmacy probably more as contextual in the sense of*
19 *what can the patient manage and what are the indications. D1026*
20
21

22 And a pharmacist: *'Irrational medications' is a good definition because some patients*
23 *would require a lot of medications, much more than five, but if they're rational, that's*
24 *fine. If they're just sort of added on and never reviewed, then that comes into my*
25 *definition of polypharmacy. P1010*
26
27

28 A nurse explained: *The person will be prescribed a new medication and they may*
29 *have some side effects from the medication, but without investigating that, they're*
30 *given more medication to treat the side effects. So that's the cascade effect. And a*
31 *lot of them aren't necessary, so that's why we should be deprescribing. N1008*
32
33

34 **Deprescribing – the current process**

35 Participants viewed deprescribing as the process of rationalising a patient's
36 medications. That is, stopping or reducing the dose of medications when the harms
37 outweigh the benefits or when medications are no longer needed.
38

39 A doctor said: *Considering the risk benefit profile of that medication, so it might have*
40 *an indication, but does the indication outweigh the risk? D4015*
41
42

43 Deprescribing was reported to occur during medicines review. Participants reported
44 that registrars and consultants were primarily responsible for deprescribing, although
45 junior doctors did deprescribe simpler medications.
46

47 A junior doctor explained: *It's kind of difficult because in that situation it's like we*
48 *have no agency, like the consultant comes in we're gonna slash this, this, and this.*
49 *D4039*
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3 A pharmacist said: *They're [JMOs are] not the ones making that decision, but they*
4 *are the ones that enter it. P5001*

6 Data obtained from observations were consistent with these views. As shown in
7 Table 2, senior doctors, including consultants and registrars, were observed to make
8 the deprescribing decisions (in 92% of deprescribing episodes), although it was the
9 junior doctors who made many of the changes to medication orders. Consultants
10 were observed to manually change a medication order in only two instances.

15 **Barriers to deprescribing**

17 A large number of barriers to deprescribing were identified via our interviews and
18 focus groups with hospital staff. Although some senior geriatricians viewed
19 deprescribing to be a central part of their role, a key barrier that emerged from
20 interviews was that hospital clinicians, particularly junior staff, did not view
21 deprescribing to be their responsibility. They viewed their primary responsibility to be
22 treating the acute health problem(s), not patients' chronic health conditions. Some
23 participants were explicit in saying that they believed it was the GP's responsibility to
24 deprescribe, not that of the hospital doctor.

25 A large number of pharmacists also explained that they thought hospital doctors
26 were reluctant to deprescribe.

27 A hospital doctor said: *Well, I rarely stop patient's medicines...I don't think I do—*
28 *unless, it's contraindicated or something, I would never really deprescribe because*
29 *maybe the GP has put them on it for a particular reason. D1063*

30 A large number of pharmacists also explained that they thought hospital doctors
31 were reluctant to deprescribe:

32 *And the doctors here are reluctant to make any changes or to stop anything because*
33 *they said, "If the GP started it, there probably is a reason why the GP started it," and*
34 *so they go back into the community with those same medications that they came in*
35 *on plus the additional ones that have been started. P3006*

36 Some hospital participants, especially more junior or less experienced staff,
37 discussed fear or insecurity associated with deprescribing.

38 A junior doctor explained: *As a JMO, I would feel uncomfortable deprescribing unless*
39 *I ran it pass the registrar first and make sure they were happy. D4040*

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3 And a pharmacist: *It really depends on the confidence of that registrar in making that*
4 *decision, the clinical decision. Because they really vary in how they feel about*
5 *making the call. And I think I sense a lot of fear about deprescribing. P3009*
6
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8 Some pharmacists and GPs indicated that a patient's hospital stay was an ideal time
9 to deprescribe. However, GPs also recognised that in-hospital deprescribing was
10 likely to be dependent on the reason for a patient's admission and the team caring
11 for a patient.
12
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15 Another key barrier to deprescribing identified was patients, particularly when
16 excluded from or not engaged in the deprescribing decision.
17

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19 A pharmacist said: *I just feel sad for the patient and I think we need to bring them*
20 *more into the discussion and get them on board because otherwise they're just going*
21 *to go home and keep taking them. P3003*
22
23

24 And a doctor explained: *When they [patients] go home, if you haven't counselled,*
25 *educated, whatever, they don't know you changed things, they're just going to do*
26 *whatever they want, they'll just revert to their normal medications. So that*
27 *engagement of the patient in the deprescribing is very important... D2012*
28
29

30 GPs also highlighted the important role patients play in deprescribing.
31

32
33 *The patient's got to understand why and how it's [deprescribing] going to happen,*
34 *and that they're going to have a sort of collaborative relationship with the GP for them*
35 *to get rid of stuff and monitor for side effects, monitor for interactions. GP7003*
36
37

38 Other barriers to deprescribing included not being able to contact the initial prescriber
39 and complexity of deprescribing. Hospital doctors explained that they were reluctant
40 to deprescribe when deprescribing was not straightforward (e.g. if weaning of the
41 medication was complex, or it would be difficult to determine the side effects of
42 deprescribing).
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46 **Communication of deprescribing decisions**

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49 Communication of deprescribing was reported to be primarily via the discharge
50 summary. Hospital clinicians said that it was important to clearly communicate what
51 is being stopped, why (including the current indication) and how (including
52 timeframe). Any in-hospital deprescribing was unlikely to be successful or sustained
53 if not communicated effectively to the GP and to the patient. This was consistent with
54 what was valued by GPs. GPs viewed communication of the reasons why
55 medications were changed or ceased by clinicians in hospital to be critical for them to
56 continue the deprescribing process.
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3 A GP explained: *If they said the reason why certain medications are being altered or*
4 *amended or stopped or started, with a reason and then sometimes there's a follow*
5 *up action... so recommend to review it in X period of time or to check their blood*
6 *pressure in a certain period of time, that's the most useful because you can*
7 *completely see the perspective having not seen what happened in the hospital. You*
8 *can get a window into the rationale behind it, and then clinically you're able to follow*
9 *up with a sensible plan. GP7001*
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17 Some GPs also expressed a preference for receiving direct communication for
18 complex patient cases.
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20 GPs felt that effective communication of in-hospital deprescribing to GPs would
21 facilitate continuity of care. If well-informed, GPs with strong, long-standing
22 relationships with patients would then be able to communicate medication changes
23 to their patients, ensuring patients are aware of how and why changes had been
24 made.
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28 *The patient's got to understand why and how it's going to happen, and that they're*
29 *going to have a sort of collaborative relationship with the GP for them to get rid of*
30 *stuff and monitor for side effects, monitor for interactions... GP7003*
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36 Preferences for electronic decision support

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38 Table 3 summarises the main preferences expressed by participants with respect to
39 the content, form and recipients of electronic decision support.
40
41

42 Table 3. User preferences for electronic decision support
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	Theme	Illustrative quotes
Content of EDS	Why and how to deprescribe	An evidence-based sort of way of deprescribing or dose reduction, yeah definitely. [Doctor 4040] When we call the doctors to say we recommend you deprescribe, we need to have a reason why we're recommending to deprescribe it. [Pharmacist 1018]
Form of EDS	Electronic guidelines	How to do the deprescribing...a guideline...where you can quickly just look up and then see if the person's yes or no. [Pharmacist 3007]

	No alerts	<p>And often a lot of these auto prompts become common enough to the point where we sort of start ignoring them on purpose. This detailed prompting is actually worsening patient care. [Doctor 4003]</p> <p>The tricky thing with alerts is there's definitely that sense of alert fatigue where you're just like, "Oh I'm sick of this. So close, nah. I'm not even following you out of spite." [Doctor 4002]</p>
	Traffic light system	I think colour's a nice idea. [Doctor 4012]
Recipients of EDS	Pharmacists	That would take some of the work off the teams... it then puts the onus onto the pharmacists...to say how big a deal is it? Get the pharmacists to talk to registrar on the ward. [Doctor 1028]
	Senior doctors	But also getting the right target. So I think it's the consultants and the registrars making a lot of the decisions. So, hounding the intern continuously with alerts, they may pass on the message? Maybe targeting the people who are more likely to make the deprescribing decision. [Doctor 4004]
	Users of the electronic system	I suppose the JMOs do most of the prescribing. Well the actual typing it out and all, hand writing stuff. They're probably your biggest people to target. [Pharmacist 5001]
	Those with limited knowledge	And that's where I think it's like a grammar and spell check. I mean if you're confident, you don't use it. You just go on, that's great, I don't need anyone to check my spelling. But if you're not, then you use something. [Doctor 2009]

Content and format of decision support

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3 When doctors, nurses and pharmacists were asked about EDS to facilitate
4 deprescribing in older inpatients, their responses were highly variable. A frequent
5 suggestion was guidelines on how to effectively deprescribe potentially inappropriate
6 medicines, with clear rationale for deprescribing, including advice on who to consult
7 and how to communicate deprescribing decisions. Participants emphasised that
8 guidance on what to do (i.e. actions to take) needed to be accompanied by strong
9 evidence for why those actions were needed. This would provide pharmacists,
10 nurses and more junior medical staff with material to support deprescribing when
11 consulting with senior clinicians.
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18 Regarding the form electronic decision support should take, clinicians were adamant
19 that alerts would not be effective because too many alerts would result in alert
20 fatigue. Almost all participants were opposed to the idea of using alerts to indicate
21 when deprescribing may be appropriate. Instead, participants liked the idea of a
22 traffic light system, where colour is used to indicate risk of adverse outcomes due to
23 polypharmacy. Participants expressed a preference for short, simple advice that is
24 easy to access (i.e. a few clicks away) and integrates well into current workflows.
25
26
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28

29 *Recipients of decision support*

30
31 Many participants, particularly doctors, indicated a preference for directing the EDS
32 to pharmacists. Clinicians felt that this would result in more of the information being
33 reviewed. Pharmacists could then communicate key potential harms and benefits to
34 doctors. Related to this, participants believed that communication of advice in person
35 was likely to be more effective than communication via a computer.
36
37
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40 With respect to doctors as the recipients of EDS, participants were divided, with
41 some indicating that junior doctors should be the target, and others indicating that it
42 should be more senior doctors.
43
44

45 One pharmacist questioned the value of designing decision support embedded in the
46 electronic system, as this would not target the senior clinicians and ultimately render
47 the decision support ineffective. *In terms of the decision being made on the patient,*
48 *you're targeting the lowest kind of person who has the least authority for making*
49 *decisions for the patient, by making a decision support tool that sits within eMR*
50 *[electronic medical record]. P1018*
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55 Other participants stressed the importance of directing decision support to those with
56 limited knowledge (i.e. those working outside of geriatrics).
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DISCUSSION

Wide engagement with hospital doctors, nurses, and pharmacists revealed variable understanding of medicines review and what this process involved. Despite this, our observational data confirmed that all clinicians undertook medicines review and were fairly consistent in how this was performed. Polypharmacy and deprescribing were well understood by all participants. The act of deprescribing was typically performed by junior doctors, and occurred during medicines review under the instruction of senior doctors. We identified a number of barriers to deprescribing, primarily a perception that deprescribing was not the responsibility of hospital doctors, a lack of confidence among junior doctors and pharmacists in broaching this topic with senior doctors, and a lack of patient engagement in the deprescribing process. Hospital staff and GPs reported that with improved communication between hospitals and GPs on how and why deprescribing occurred, these decisions were more likely to be sustained.

In consolidating our results, we aimed to inform the design of EDS by determining the right information to provide, the right time to provide it and the right person to target.[9] As deprescribing decisions were made at multiple time points throughout a patient's admission, particularly during a patient's initial medicines review, the EDS would need to be available at all times or 'on-demand' to accommodate various clinical workflows. As decision support would be embedded within the electronic medical record, it follows that the recipients of the EDS would be the users of the electronic system. Our observations confirmed that junior doctors, pharmacists and nurses used the system to a much greater extent than the primary decision-makers (senior doctors), a finding consistent with other research.[13] Thus, the EDS would need to be informative and relevant so as to motivate users to initiate a conversation with the senior clinician. Junior doctors, pharmacists and nurses expressed a strong preference for guidance on not only *how* to deprescribe but *why*, this latter information required to support deprescribing when consulting with senior doctors. Finally, EDS should facilitate communication of information about in-hospital deprescribing, including what medications were changed and why, to patients' primary care providers.

We found strong resistance among users to the implementation of interruptive alerts to signal patient risk or polypharmacy. Alerts are frequently used form of decision support, but are often not read.[15] Alert fatigue, a consequence of too many false-positive alerts being triggered, is a common and persistent problem.[16] Opposition to the inclusion of alerts in our study is therefore not surprising and is consistent with

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3 previous reviews of EDS for deprescribing, which highlight the challenges of using
4 alerts.[10, 11]
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7 In overcoming the barriers to deprescribing we identified, EDS is likely to represent
8 only one component of a multi-faceted intervention. EDS can prompt users when
9 patients are at risk of polypharmacy and subsequently provide junior doctors, nurses
10 and pharmacists with evidence to alert and influence the senior clinicians, increasing
11 perceived competence and self-confidence. However, to shift perceptions of roles
12 and responsibilities, it is likely that an additional approach will be needed. For
13 example, the Behaviour Change Wheel, a well-known framework of behaviour
14 change interventions,[17] suggests beliefs about professional role (i.e. motivation)
15 are influenced by training and by policy change, such as regulation. Interestingly,
16 Australia's updated standards for hospital accreditation include in-hospital medication
17 review and shared decision making with consumers.[18]
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21 A key result that emerged from our study was the vital role that patients play in
22 deprescribing. Both hospital staff and GPs emphasised the importance of engaging
23 patients in the process, in order to ensure continuity of care and prevent re-
24 prescribing. The benefits of shared decision making are well known,[19, 20] although
25 research has suggested that it is not often practiced.[21] EDS can facilitate patient
26 engagement in deprescribing to some extent by, for example, automatically
27 populating deprescribing decisions into a patient's discharge summary, providing
28 GPs with the critical information to reiterate and reinforce decisions made in hospital
29 to the patient. However, communication between in-hospital clinicians and patients
30 on rationale, expectations and preferences is likely to be a more effective approach
31 in ensuring deprescribing decisions are understood, agreed with, and sustained,
32 which is a focus of our ongoing research.
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35 36 37 38 39 40 41 42 43 44 **Strengths and weaknesses of the study**

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46 This study comprised an in-depth investigation of medicines review and
47 deprescribing with a large number of multi-disciplinary clinicians. By complementing
48 interviews with in situ observation, we were able to validate some participants'
49 perceptions with objective data, although we acknowledge that our results are
50 primarily drawn from interviews and may be subject to biases associated with self-
51 report. The perceptions and practices described are likely to be representative of
52 geriatric medicine, general medicine and rehabilitation wards in metropolitan Sydney
53 teaching hospitals, and may not be generalisable to other clinical services or different
54 settings. In particular, while addressing the patient's chronic disease management
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(which includes medication review) is considered part of standard comprehensive geriatric assessment and best practice for older adults admitted to hospital,[22] this may not be the standard model of care for other specialties.

Conclusion

Deprescribing, undertaken during medicines review, is often performed by a junior doctor, following a decision to deprescribe by a senior doctor. In designing effective decision support for deprescribing in the electronic medical record, the EDS, likely to be used by junior doctors, pharmacists and nurses, should be available throughout the hospitalisation and should comprise non-interruptive evidence-based guidance on why and how to deprescribe. Deprescribing decisions are complex and influenced by multiple factors. Thus, the implementation of EDS alone may not result in sustained improvements in review of polypharmacy and subsequent deprescribing. Our future work will focus on developing and refining EDS design, while developing complementary interventions with clinicians and patients.

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COMPETING INTERESTS

The authors have no competing interests to declare.

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AUTHOR STATEMENT

SNH, MTB, DGLC, AJM, and AB all made contributions to study conception and design. MD, ADN, SL and BN undertook data collection, MTB, MD, ADN, and WYZ undertook data analysis and all authors contributed to data interpretation, particularly AR who provided input with respect to the electronic system. All authors contributed to and approved the final manuscript.

DATA SHARING

No additional data are available.

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For peer review only

Supplementary file

Additional information on study context

In Australia, General Practitioners' exposure to hospital processes is typically limited to the information contained in patients' discharge summaries. Medical service teams in Australian public hospitals are comprised of a mix of staff of varying post-graduate years experience. They are led by consultants, who are not always on site, and overseen by specialist trainees (registrars), who in turn supervise one or more junior doctors. The term 'junior doctor' is often used to describe any medical officer who is not a consultant. Junior doctors are usually responsible for the day-to-day tasks of patient management including clerking admissions and discharges, daily rounding on inpatients, order entry, clinical documentation, requesting and reviewing consultations and minor procedures.

Interview Guide - Hospital Staff

Current medicine review

1. Can you describe the current process of medicine review?
2. What normally happens during medicine review?
3. Do you think medicine review is done well? Why/why not?
4. Can you think of anything that would help you review medicines more quickly or easily?

Polypharmacy and deprescribing

5. What is your understanding of polypharmacy and deprescribing?
6. Do you think polypharmacy is a problem in older inpatients?
7. Can you think of any ways to reduce inappropriate polypharmacy in hospital?
8. Are there any drugs that are harder or easier to deprescribe in hospital?

Decision support

9. What information do you think the decision support should convey?
10. Who do think that decision support should be directed to?
11. Where and when would it be most useful?
12. Do you think decision support should target complex or common situations?

Interview Guide - General Practitioners

Current medicine review for your patients during hospital admission

1. Can you describe the medicine reviews that occur for your patients in the hospital?
2. Do you think medicine review in hospital is done well? Why/why not?
3. Do you think medicine review in hospital is communicated well to you? What is the best way to communicate medicine changes to you?
4. How active would you like to be in the decision making process when changes are made to patients admitted to hospital?
5. Can you think of anything that would improve medicine review for your patients admitted to hospital?

Polypharmacy and deprescribing

6. What is your understanding of polypharmacy and deprescribing?
7. Do you think polypharmacy should be reviewed during hospital admission? Why/why not?
8. How do you think information about polypharmacy and deprescribing should be communicated to you on discharge?

Decision support on discharge to improve continuity of medication management after review in hospital

9. We are designing protocols to guide continuity of medicine changes made during hospital review on discharge. What information do you think the decision support tool should convey?
10. What type of decision support would be most effective?

Standards for Reporting Qualitative Research (SRQR) - checklist

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BMJ Open

Delivering the right information to the right person at the right time to facilitate deprescribing in hospital: A mixed-methods multi-site study to inform decision support design in Australia

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Keywords:	Polypharmacy, Deprescribing, Decision support

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4 **deprescribing in hospital: A mixed-methods multi-site study to inform decision**
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Abstract

Objectives: To inform the design of electronic decision support (EDS) to facilitate deprescribing in hospitals we set out to 1) explore the current processes of in-hospital medicines review, deprescribing and communication of deprescribing decisions with the patient's general practitioner (GP), 2) identify barriers to undertaking these tasks, and 3) determine user preferences for EDS.

Design: Multi-method, multi-site study comprising observations, semi-structured interviews and focus groups.

Setting: General medicine, geriatric medicine and rehabilitation wards at six hospitals in two local health districts in Sydney, Australia, and primary care practices in one primary healthcare district in Sydney, Australia.

Participants: 149 participants took part in observations, interviews and focus groups, including 69 hospital doctors, 13 nurses, 55 pharmacists and 12 GPs.

Main outcome measures: Observational data on who was involved in medicines review and deprescribing, when medicines review took place, and what artifacts (e.g. forms) were used. Participants' reported perceptions of medicines review, polypharmacy, and deprescribing, and preferences for EDS.

Results: Deprescribing, undertaken during medicines review, was typically performed by a junior doctor, following a decision to deprescribe by a senior doctor. Key barriers to deprescribing included a perception that deprescribing was not the responsibility of hospital doctors, a lack of confidence among junior doctors and pharmacists in broaching this topic with senior doctors, and a lack of patient engagement in the deprescribing process. In designing EDS, the tools, likely to be used by junior doctors, pharmacists and nurses, should be available throughout the hospitalisation and should comprise non-interruptive evidence-based guidance on why and how to deprescribe.

Conclusions: Deprescribing decisions are complex and influenced by multiple factors. The implementation of EDS alone is unlikely to address all barriers identified. To achieve sustained improvements in monitoring of polypharmacy and subsequent deprescribing, a multi-faceted intervention is needed.

ARTICLE SUMMARY

Strengths and limitations of this study

- This multi-method, multi-site study comprised an in-depth investigation of medicines review and deprescribing with a large number of multi-disciplinary clinicians.
- By complementing interviews with in situ observation, we were able to validate some participants' perceptions with objective data
- Our results are primarily drawn from interviews and may be subject to biases associated with self-report.
- The perceptions and practices described may not be generalisable to other clinical services or different settings.

INTRODUCTION

Potentially inappropriate polypharmacy occurs in approximately half of older hospitalised patients internationally and is not usually addressed during routine hospital care.[1, 2] Addressing inappropriate polypharmacy in older inpatients is essential to meet the Third World Health Organization (WHO) Global Patient Safety Challenge: 'Medication Without Harm', which targets high risk situations, polypharmacy and transitions of care, aiming to reduce avoidable harm related to medications by 50% over five years.[3] The hospital setting provides an opportunity for undertaking comprehensive medication reviews, one possible outcome of which is deprescribing. Deprescribing, defined as the cessation of a potentially inappropriate medication, supervised by a health care professional with the goal of managing polypharmacy and improving health outcomes,[4] is gaining momentum internationally.[4-6]

As hospitals are increasingly transitioning from paper-based medication charts to electronic order entry systems, an opportunity exists to integrate decision support and guidance for medication review and deprescribing into these systems. There is now good evidence to show that when well-designed and targeted, electronic decision support (EDS) can have significant impacts on care outcomes.[7-9] This is applicable to decision support targeting potentially inappropriate prescribing, with two recent reviews determining that computerised interventions are effective in reducing potentially inappropriate prescribing in hospitalised patients.[10, 11] However, there are also an increasing number of studies demonstrating that decision support is ignored or not used by clinicians.[12, 13] In fact, both above-mentioned reviews highlighted this problem and stressed the importance of working with users to ensure decision support is relevant and aligns well with clinician workflow.[10, 11]

Small scale, single-site studies have explored provider awareness and barriers to medication review and deprescribing[14-16] but an in-depth understanding of current processes and barriers across different provider groups and settings is required in order to design EDS for hospital practice to align well with the workflow of all users. EDS can facilitate decision making if it provides the right information at the right time to the right person.[9] However, determining the right information, and identifying the right time and person to target is challenging. The aim of this study was to explore the current processes of in-hospital medicines review, deprescribing and communication of deprescribing with the patient's general practitioner (GP). In particular, we aimed to identify barriers to undertaking these tasks, and to explore

user preferences for decision support, in order to inform the design of electronic decision support to support these key processes.

METHOD

A multi-methods approach was used comprising observations of clinicians (doctors and pharmacists), and interviews and focus groups with clinicians (hospital doctors, nurses, pharmacists and GPs).

Setting and participants

This study was undertaken at six hospitals in two local health districts, and in primary care practices in one primary healthcare district in Sydney, Australia. These districts were selected because they were located in different socioeconomic regions in Sydney. Small, medium and large hospitals in each region were included as study sites. See Supplementary file for additional information on study context.

Table 1 outlines details of the study sites at the time of data collection and the participants who took part. All hospitals used a commercial clinical information system, PowerChart® (current code level 2015, Cerner Corporation, Kansas City, MO <https://www.cerner.com>), but only one hospital used electronic medication management at the time of data collection.

Table 1. Study site information and details of interviews, focus groups and observations undertaken.

	Type of hospital, approximate number of beds	Clinical information systems, paper systems	Number of participants interviewed	Approximate hours of observation	Number of participants observed
Site A	Tertiary referral, >500	Electronic ordering for tests and imaging Electronic progress notes	11 Doctors 7 Nurses 21 Pharmacists	17 hours	13 Doctors 1 Pharmacist

		Paper-based medication charts			
Site B	Tertiary referral and rehabilitation, >500	Electronic ordering for tests and imaging Electronic progress notes Electronic medication charts	20 Doctors 15 Pharmacists	21 hours	16 Doctors 2 Pharmacists
Site C	Acute district, 100-199	Electronic ordering for tests and imaging Electronic progress notes Paper-based medication charts	-	6 hours	2 Doctors
Site D	Geriatric and rehabilitation, 50-99	Electronic ordering for tests and imaging Paper-based progress notes Paper-based medication charts	1 Pharmacist	7.5 hours	8 Doctors 1 Pharmacist
Site E	Acute district and	Electronic ordering for	11 Pharmacists	-	-

	rehabilitation, 100-199	tests and imaging Paper-based progress notes Paper-based medication charts			
Site F	Acute district and rehabilitation, 200-500	Electronic ordering for tests and imaging Paper-based progress notes Paper-based medication charts	11 Doctors 6 Nurses 5 Pharmacists	-	-
Primary care			12 GPs	-	-

Note: Some participants took part in both observations and interviews.

To recruit hospital participants, researchers attended existing education sessions and ward meetings to deliver brief presentations on the project, and posters were displayed on wards. Relevant clinical leads were also informed of the study and asked to direct interested participants to researchers. To recruit GPs, advertisements were sent out through the local primary care health network promotional channels and interested participants contacted the researcher directly.

In total, 149 clinicians participated in the study across six hospitals and the community (69 hospital doctors, 55 pharmacists, 13 nurses and 12 GPs). The study included hospital-based doctors, nurses and pharmacists who work in geriatric medicine, general medicine and rehabilitation wards at each site. Approximately 52 hours of observation were undertaken across four hospitals (Table 1 and Supplementary file).

Data collection

Observations of hospital clinicians

Researchers (two pharmacists and a geriatrician) shadowed hospital clinicians as they completed routine tasks related to medicines review and collected detailed hand-written notes on the following: who was involved in medicines review and deprescribing, where medicines review took place, and what artifacts (e.g. forms, electronic systems) were used. Researchers also classified the type of medicines review that they observed into either 1) an initial review at admission to hospital, 2) a review during a patient's stay (i.e. follow-up), or 3) a review at discharge from hospital.

Interviews and focus groups with hospital-based clinicians and general practitioners

Semi-structured interviews and focus groups with hospital clinicians focused on four main areas: the current process of medicines review, polypharmacy, deprescribing, and preferences for EDS. Interview questions are presented in the Supplementary file. Semi-structured interviews and focus group with GPs in primary care practices focused on four main areas: perceptions of the current process of medicines review in hospital, polypharmacy, deprescribing, and preferences for communication of in-hospital deprescribing on discharge to improve continuity of medication management after review in hospital.

Data analysis

Hand-written notes were taken during observations and were collated to enable identification of key elements of medicines review and deprescribing.

Interviews and focus groups were audio-recorded, transcribed verbatim and de-identified. An iterative general inductive approach was used for analysis.[17] Three researchers independently reviewed de-identified transcripts and coded the data. The four focus areas (medicines review, polypharmacy, deprescribing and EDS) guided initial coding of the transcripts. Multidisciplinary researchers, including clinicians, EDS specialists and researchers with expertise in qualitative research, met periodically throughout data collection to discuss and compare identified themes. Any disagreements in themes were discussed until a consensus was reached.

Public and patient involvement statement

No patients or the public were involved in any stage of the research process for this study.

Ethics approval

Ethics approval was obtained from Northern Sydney Local Health District Human Research Ethics Committee (LNR/17/HAWKE/138), with site specific approval obtained from each participating hospital. Written informed consent was obtained from all participants in the study.

RESULTS

Medicines review – the current process

In total, 117 instances of medicines review were observed across four hospitals.

Table 2 summarises the data collected from observations.

Table 2. Characteristics of medicines reviews and episodes of deprescribing observed during 52 hours of observations across four Sydney hospitals.

		Site A	Site B	Site C	Site D
		Number of times observed			
Medicine reviews		39	45	12	21
Type of medicine review	Initial review	5	9	1	3
	Follow-up	23	30	5	14
	Discharge	11	6	6	4
Location of medicine review*	Hallway	16	19	9	7
	Patient bedside	19	31	8	10
	Other (e.g. office)	7	6	2	5
Type of device used*	COW	26	37	10	5
	Computer at JMO/registrars workstation	3	3	2	2

	Computer at pharmacy workstation	-	3	-	1
Medicine reviews where deprescribing occurred		15 (38%)	24 (53%)	4 (33%)	7 (33%)
In deprescribing cases:					
Provider who requested the change to a medication	Consultant	11	11	1	6
	Registrar	3	10	3	1
	JMO	-	3	-	-
	Pharmacist	1	-	-	-
Provider who changed the medication	Consultant	-	2	-	-
	Registrar	6	7	4	5
	JMO	9	15	-	2
Artefacts accessed* <i>Italicised artefacts are those accessed via the electronic medical record</i>	Paper medication chart	11	-	4	6
	Patient list	4	12	1	1
	Observations	-	-	2	1
	Progress notes	13	14	3	-
	Test results	8	18	3	2
	Medication list	-	8	-	-
	MAR/MAR Summary	-	20	-	-

	<i>Orders (medications, pathology)</i>	6	5	2	-
	<i>Observations</i>	4	6	-	-
	<i>External resources (CIAP to access AMH, MIMS, eTG)</i>	1	5	1	-

*Numbers are greater than total events observed as single events could have included multiple locations, devices and artefacts

Note: COW = Computer on wheels; MAR = Medication Administration Record; JMO = Junior medical officer; AMH = Australian Medicines Handbook; CIAP = Clinical Information Access Portal; MIMS = Monthly Index of Medical Specialties, eTG = Electronic Therapeutic Guidelines

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5 During interviews and focus groups with hospital staff, participants demonstrated an
6 inconsistent understanding of what medicines review was and of what it involved.
7 Participants spoke about obtaining a best possible medication history, undertaking
8 medication reconciliation, and reviewing inpatient medication charts.
9

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11
12 A pharmacist said: *By med review, are you talking about the first med review, when*
13 *you're doing the history and the whole full thing or are you talking about a daily or*
14 *every two days, whatever you might do, have a new order, check the new antibiotic*
15 *and see if it's appropriate, are there any interactions? That also can be called a med*
16 *review. P1013*
17
18
19

20
21 And a doctor: *I think it's a little undefined in terms of who does it, and depending on*
22 *the time of the day, even the day of the week, you'll have different people doing it.*
23
24 *D4004*
25
26
27

28 Most participants explained that a medicines review was undertaken within a few
29 days of admission and triggered at certain time points in a patient's journey, such as
30 transfer between settings (e.g. emergency department to the ward) and at discharge
31 from hospital. This is consistent with what we observed on wards (see Table 2).
32 During discussions with staff it became apparent that medicines review was
33 perceived to be the role of doctors, both senior and junior, and of pharmacists.
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38 Participants reported that common triggers for medicines review were patient factors
39 (e.g. age, comorbidities), medication-related factors (e.g. high risk medicines) and
40 requests from other healthcare providers.
41
42

43 The information that participants reported accessing during medicines review
44 depended on their understanding of the process. For example, participants noted
45 that key information sources for medication reconciliation were GPs, patients,
46 families, residential aged care facilities, and pharmacies. Participants who viewed
47 medicines review as a review of the inpatient medication chart described accessing
48 inpatient notes, medications and pathology results. This is consistent with what we
49 observed (Table 2).
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54 **Barriers to medicines review**

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56 The main barrier reported to impact on medicines review was limited time.
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3 A pharmacist said: *Obviously, ideally, you would want to do that medication review*
4 *after you do that history taking. But then, you have so many patients that come in*
5 *that all need history taking... we just don't have time. P2004*
6
7

8 Other reported barriers were short length of stay (preventing a detailed review), and
9 missing or unreliable information in clinical information systems.
10

11 **Awareness and understanding of polypharmacy**

12
13
14 Participants appeared to have a strong understanding of polypharmacy, with many
15 emphasising that it is not simply the number of medications that a patient is taking,
16 but also whether the medications are needed. Clinicians discussed the concept of
17 inappropriate polypharmacy for the individual patient.
18

19
20
21 A doctor said: *I think of polypharmacy probably more as contextual in the sense of*
22 *what can the patient manage and what are the indications. D1026*
23

24
25 And a pharmacist: *'Irrational medications' is a good definition because some patients*
26 *would require a lot of medications, much more than five, but if they're rational, that's*
27 *fine. If they're just sort of added on and never reviewed, then that comes into my*
28 *definition of polypharmacy. P1010*
29

30
31 A nurse explained: *The person will be prescribed a new medication and they may*
32 *have some side effects from the medication, but without investigating that, they're*
33 *given more medication to treat the side effects. So that's the cascade effect. And a*
34 *lot of them aren't necessary, so that's why we should be deprescribing. N1008*
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40 **Deprescribing – the current process**

41
42 Participants viewed deprescribing as the process of rationalising a patient's
43 medications. That is, stopping or reducing the dose of medications when the harms
44 outweigh the benefits or when medications are no longer needed.
45

46
47 A doctor said: *Considering the risk benefit profile of that medication, so it might have*
48 *an indication, but does the indication outweigh the risk? D4015*
49

50
51 Deprescribing was reported to occur during medicines review, as an outcome of the
52 review. Participants reported that registrars and consultants were primarily
53 responsible for deprescribing, although junior doctors did deprescribe medications
54 where it was clear to them that there was no current indication, (e.g. common
55 electrolytes, antihypertensives, proton pump inhibitors and analgesics), and/or
56 medications that were causing adverse effects in the patient. A junior doctor
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3 explained: *It's kind of difficult because in that situation it's like we have no agency,*
4 *like the consultant comes in we're gonna slash this, this, and this. D4039*

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6
7 A pharmacist said: *They're [JMOs are] not the ones making that decision, but they*
8 *are the ones that enter it. P5001*

9
10 Data obtained from observations were consistent with these views. As shown in
11 Table 2, senior doctors, including consultants and registrars, were observed to make
12 the deprescribing decisions (in 92% of deprescribing episodes), although it was the
13 junior doctors who made many of the changes to medication orders. Consultants
14 were observed to manually change a medication order in only two instances.

15 16 17 18 **Barriers to deprescribing**

19
20 A large number of barriers to deprescribing were identified via our interviews and
21 focus groups with hospital staff. Although some senior geriatricians viewed
22 deprescribing to be a central part of their role, a key barrier that emerged from
23 interviews was that hospital clinicians, particularly junior staff, did not view
24 deprescribing to be their responsibility. They viewed their primary responsibility to be
25 treating the acute health problem(s), not patients' chronic health conditions. Some
26 participants were explicit in saying that they believed it was the GP's responsibility to
27 deprescribe, not that of the hospital doctor.

28
29 A hospital doctor said: *Well, I rarely stop patient's medicines...I don't think I do—*
30 *unless, it's contraindicated or something, I would never really deprescribe because*
31 *maybe the GP has put them on it for a particular reason. D1063*

32
33 A large number of pharmacists also explained that they thought hospital doctors
34 were reluctant to deprescribe:

35
36 *And the doctors here are reluctant to make any changes or to stop anything because*
37 *they said, "If the GP started it, there probably is a reason why the GP started it," and*
38 *so they go back into the community with those same medications that they came in*
39 *on plus the additional ones that have been started. P3006*

40
41 Some hospital participants, especially more junior or less experienced staff,
42 discussed fear or insecurity associated with deprescribing.

43
44 A junior doctor explained: *As a JMO, I would feel uncomfortable deprescribing unless*
45 *I ran it pass the registrar first and make sure they were happy. D4040*

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2
3 And a pharmacist: *It really depends on the confidence of that registrar in making that*
4 *decision, the clinical decision. Because they really vary in how they feel about*
5 *making the call. And I think I sense a lot of fear about deprescribing. P3009*
6
7

8 Some pharmacists and GPs indicated that a patient's hospital stay was an ideal time
9 to deprescribe. However, GPs also recognised that in-hospital deprescribing was
10 likely to be dependent on the reason for a patient's admission and the team caring
11 for a patient.
12
13

14
15 Another key barrier to deprescribing identified was patients, particularly when
16 excluded from or not engaged in the deprescribing decision.
17

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19 A pharmacist said: *I just feel sad for the patient and I think we need to bring them*
20 *more into the discussion and get them on board because otherwise they're just going*
21 *to go home and keep taking them. P3003*
22
23

24 And a doctor explained: *When they [patients] go home, if you haven't counselled,*
25 *educated, whatever, they don't know you changed things, they're just going to do*
26 *whatever they want, they'll just revert to their normal medications. So that*
27 *engagement of the patient in the deprescribing is very important... D2012*
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29

30 GPs also highlighted the important role patients play in deprescribing.
31

32
33 *The patient's got to understand why and how it's [deprescribing] going to happen,*
34 *and that they're going to have a sort of collaborative relationship with the GP for them*
35 *to get rid of stuff and monitor for side effects, monitor for interactions. GP7003*
36
37

38 Other barriers to deprescribing included not being able to contact the initial prescriber
39 and complexity of deprescribing. Hospital doctors explained that they were reluctant
40 to deprescribe when deprescribing was not straightforward (e.g. if weaning of the
41 medication was complex, or it would be difficult to determine the side effects of
42 deprescribing).
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46 **Communication of deprescribing decisions**

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48
49 Communication of deprescribing was reported to be primarily via the discharge
50 summary. Hospital clinicians said that it was important to clearly communicate what
51 is being stopped, why (including the current indication) and how (including
52 timeframe). Any in-hospital deprescribing was unlikely to be successful or sustained
53 if not communicated effectively to the GP and to the patient. This was consistent with
54 what was valued by GPs. GPs viewed communication of the reasons why
55 medications were changed or ceased by clinicians in hospital to be critical for them to
56 continue the deprescribing process.
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3 A GP explained: *If they said the reason why certain medications are being altered or*
4 *amended or stopped or started, with a reason and then sometimes there's a follow*
5 *up action... so recommend to review it in X period of time or to check their blood*
6 *pressure in a certain period of time, that's the most useful because you can*
7 *completely see the perspective having not seen what happened in the hospital. You*
8 *can get a window into the rationale behind it, and then clinically you're able to follow*
9 *up with a sensible plan. GP7001*
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17 Some GPs also expressed a preference for receiving direct communication for
18 complex patient cases.
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20 GPs felt that effective communication of in-hospital deprescribing to GPs would
21 facilitate continuity of care. If well-informed, GPs with strong, long-standing
22 relationships with patients would then be able to communicate medication changes
23 to their patients, ensuring patients are aware of how and why changes had been
24 made.
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31 Preferences for electronic decision support

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33 Table 3 summarises the main preferences expressed by participants with respect to
34 the content, form and recipients of electronic decision support.
35

36 Table 3. User preferences for electronic decision support
37
38

	Theme	Illustrative quotes
Content of EDS	Why and how to deprescribe	<i>An evidence-based sort of way of deprescribing or dose reduction, yeah definitely. [Doctor 4040]</i> <i>When we call the doctors to say we recommend you deprescribe, we need to have a reason why we're recommending to deprescribe it. [Pharmacist 1018]</i>
Form of EDS	Electronic guidelines No alerts	<i>How to do the deprescribing...a guideline...where you can quickly just look up and then see if the person's yes or no. [Pharmacist 3007]</i> <i>And often a lot of these auto prompts become common enough to the point where we sort of start ignoring them on purpose. This detailed prompting is actually worsening patient care. [Doctor 4003]</i>

	Traffic light system	<p><i>The tricky thing with alerts is there's definitely that sense of alert fatigue where you're just like, "Oh I'm sick of this. So close, nah. I'm not even following you out of spite."</i></p> <p><i>[Doctor 4002]</i></p> <p><i>I think colour's a nice idea. [Doctor 4012]</i></p>
Recipients of EDS	Pharmacists	<p><i>That would take some of the work off the teams... it then puts the onus onto the pharmacists...to say how big a deal is it? Get the pharmacists to talk to registrar on the ward. [Doctor 1028]</i></p>
	Senior doctors	<p><i>But also getting the right target. So I think it's the consultants and the registrars making a lot of the decisions. So, hounding the intern continuously with alerts, they may pass on the message? Maybe targeting the people who are more likely to make the deprescribing decision. [Doctor 4004]</i></p>
	Users of the electronic system	<p><i>I suppose the JMOs do most of the prescribing. Well the actual typing it out and all, hand writing stuff. They're probably your biggest people to target. [Pharmacist 5001]</i></p>
	Those with limited knowledge	<p><i>And that's where I think it's like a grammar and spell check. I mean if you're confident, you don't use it. You just go on, that's great, I don't need anyone to check my spelling. But if you're not, then you use something. [Doctor 2009]</i></p>

Content and format of decision support

When doctors, nurses and pharmacists were asked about EDS to facilitate deprescribing in older inpatients, their responses were highly variable. A frequent suggestion was guidelines on how to effectively deprescribe potentially inappropriate medicines, with clear rationale for deprescribing, including advice on who to consult

1
2
3 and how to communicate deprescribing decisions. Participants emphasised that
4 guidance on what to do (i.e. actions to take) needed to be accompanied by strong
5 evidence for why those actions were needed. This would provide pharmacists,
6 nurses and more junior medical staff with material to support deprescribing when
7 consulting with senior clinicians.
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11 Regarding the form electronic decision support should take, clinicians were adamant
12 that alerts would not be effective because too many alerts would result in alert
13 fatigue. Almost all participants were opposed to the idea of using alerts to indicate
14 when deprescribing may be appropriate. Instead, participants liked the idea of a
15 traffic light system, where colour is used to indicate risk of adverse outcomes due to
16 polypharmacy. Participants expressed a preference for short, simple advice that is
17 easy to access (i.e. a few clicks away) and integrates well into current workflows.
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23 *Recipients of decision support*

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25 Many participants, particularly doctors, indicated a preference for directing the EDS
26 to pharmacists. Clinicians felt that this would result in more of the information being
27 reviewed. Pharmacists could then communicate key potential harms and benefits to
28 doctors. Related to this, participants believed that communication of advice in person
29 was likely to be more effective than communication via a computer.
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33 With respect to doctors as the recipients of EDS, participants were divided, with
34 some indicating that junior doctors should be the target, and others indicating that it
35 should be more senior doctors.
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39 One pharmacist questioned the value of designing decision support embedded in the
40 electronic system, as this would not target the senior clinicians and ultimately render
41 the decision support ineffective. *In terms of the decision being made on the patient,*
42 *you're targeting the lowest kind of person who has the least authority for making*
43 *decisions for the patient, by making a decision support tool that sits within eMR*
44 *[electronic medical record]. P1018*
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49 Other participants stressed the importance of directing decision support to those with
50 limited knowledge (i.e. those working outside of geriatrics).
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54 **DISCUSSION**

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56 Wide engagement with hospital doctors, nurses, and pharmacists revealed variable
57 understanding of medicines review and what this process involved. Despite this, our
58 observational data confirmed that all clinicians undertook medicines review and were
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3 fairly consistent in how this was performed. Polypharmacy and deprescribing were
4 well understood by all participants. The act of deprescribing was typically performed
5 by junior doctors, and occurred during medicines review under the instruction of
6 senior doctors. We identified a number of barriers to deprescribing, primarily a
7 perception that deprescribing was not the responsibility of hospital doctors, a lack of
8 confidence among junior doctors and pharmacists in broaching this topic with senior
9 doctors, and a lack of patient engagement in the deprescribing process. Hospital
10 staff and GPs reported that with improved communication between hospitals and
11 GPs on how and why deprescribing occurred, these decisions were more likely to be
12 sustained.
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19 In consolidating our results, we aimed to inform the design of EDS by determining
20 the right information to provide, the right time to provide it and the right person to
21 target.[9] As deprescribing decisions were made at multiple time points throughout a
22 patient's admission, particularly during a patient's initial medicines review, the EDS
23 would need to be available at all times or 'on-demand' to accommodate various
24 clinical workflows. As decision support would be embedded within the electronic
25 medical record, it follows that the recipients of the EDS would be the users of the
26 electronic system. Our observations confirmed that junior doctors, pharmacists and
27 nurses used the system to a much greater extent than the primary decision-makers
28 (senior doctors), a finding consistent with other research.[13] Thus, the EDS would
29 need to be informative and relevant so as to motivate users to initiate a conversation
30 with the senior clinician. Junior doctors, pharmacists and nurses expressed a strong
31 preference for guidance on not only *how* to deprescribe but *why*, this latter
32 information required to support deprescribing when consulting with senior doctors.
33 Finally, EDS should facilitate communication of information about in-hospital
34 deprescribing, including what medications were changed and why, to patients'
35 primary care providers.
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47 We found strong resistance among users to the implementation of interruptive alerts
48 to signal patient risk or polypharmacy. Alerts are frequently used form of decision
49 support, but are often not read.[18] Alert fatigue, a consequence of too many false-
50 positive alerts being triggered, is a common and persistent problem.[19] Opposition
51 to the inclusion of alerts in our study is therefore not surprising and is consistent with
52 previous reviews of EDS for deprescribing, which highlight the challenges of using
53 alerts.[10, 11]
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59 The barriers to deprescribing we identified in our study are in-line with those reported
60 in previous research, including a diffusion of responsibility and low self-efficacy (i.e.

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3 confidence in knowing when to approach senior staff).[14-16, 20] In overcoming
4 these barriers, EDS is likely to represent only one component of a multi-faceted
5 intervention. EDS can prompt users when patients are at risk of polypharmacy and
6 subsequently provide junior doctors, nurses and pharmacists with evidence to alert
7 and influence the senior clinicians, increasing perceived competence and self-
8 confidence. However, to shift perceptions of roles and responsibilities, it is likely that
9 an additional approach will be needed. For example, the Behaviour Change Wheel, a
10 well-known framework of behaviour change interventions,[21] suggests beliefs about
11 professional role (i.e. motivation) are influenced by training and by policy change,
12 such as regulation. Interestingly, Australia's updated standards for hospital
13 accreditation include in-hospital medication review and shared decision making with
14 consumers.[22]

15
16 A key result that emerged from our study was the vital role that patients play in
17 deprescribing. Both hospital staff and GPs emphasised the importance of engaging
18 patients in the process, in order to ensure continuity of care and prevent re-
19 prescribing. The benefits of shared decision making are well known,[23, 24] although
20 research has suggested that it is not often practiced.[25] EDS can facilitate patient
21 engagement in deprescribing to some extent by, for example, automatically
22 populating deprescribing decisions into a patient's discharge summary, providing
23 GPs with the critical information to reiterate and reinforce decisions made in hospital
24 to the patient. In addition, communication between in-hospital clinicians and patients
25 on rationale, expectations and preferences is likely to result in a more effective
26 approach than EDS alone, in ensuring deprescribing decisions are understood,
27 agreed with, and sustained, which is a focus of our ongoing research.

28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 **Strengths and weaknesses of the study**

43
44 This study comprised an in-depth investigation of medicines review and
45 deprescribing with a large number of multi-disciplinary clinicians. By complementing
46 interviews with in situ observation, we were able to validate some participants'
47 perceptions with objective data, although we acknowledge that our results are
48 primarily drawn from interviews and may be subject to biases associated with self-
49 report. The perceptions and practices described are likely to be representative of
50 geriatric medicine, general medicine and rehabilitation wards in metropolitan Sydney
51 teaching hospitals, and may not be generalisable to other clinical services or different
52 settings. In particular, while addressing the patient's chronic disease management
53 (which includes medication review) is considered part of standard comprehensive
54 geriatric assessment and best practice for older adults admitted to hospital,[26] this
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3 may not be the standard model of care for other hospital specialties or primary care
4 settings such as nursing homes.
5

6 7 **Conclusion**

8
9 Deprescribing, undertaken during medicines review, is often performed by a junior
10 doctor, following a decision to deprescribe by a senior doctor. In designing effective
11 decision support for deprescribing in the electronic medical record, the EDS, likely to
12 be used by junior doctors, pharmacists and nurses, should be available throughout
13 the hospitalisation and should comprise non-interruptive evidence-based guidance
14 on why and how to deprescribe. Deprescribing decisions are complex and influenced
15 by multiple factors. Thus, the implementation of EDS alone may not result in
16 sustained improvements in review of polypharmacy and subsequent deprescribing.
17 Our future work will focus on developing and refining EDS design, while developing
18 complementary interventions with clinicians and patients.
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28
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30 Network in recruiting General Practitioners for this study.
31
32

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34
35 The authors have no competing interests to declare.
36
37

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42 interpretation of data, in writing of the paper or in the decision to submit the article for
43 publication.
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49 **AUTHOR STATEMENT**

50
51 SNH, MTB, DGLC, AJM, and AB all made contributions to study conception and
52 design. MD, ADN, SL and BN undertook data collection, MTB, MD, ADN, and WYZ
53 undertook data analysis and all authors contributed to data interpretation, particularly
54 AR who provided input with respect to the electronic system. All authors contributed
55 to and approved the final manuscript.
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59 **DATA SHARING**

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3 Non-identifiable data are available on request from authors.
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Supplementary file

Additional information on study context

In Australia, General Practitioners' exposure to hospital processes is typically limited to the information contained in patients' discharge summaries. Medical service teams in Australian public hospitals are comprised of a mix of staff of varying post-graduate years experience. They are led by consultants, who are not always on site, and overseen by specialist trainees (registrars), who in turn supervise one or more junior doctors. The term 'junior doctor' is often used to describe any medical officer who is not a consultant. Junior doctors are usually responsible for the day-to-day tasks of patient management including clerking admissions and discharges, daily rounding on inpatients, order entry, clinical documentation, requesting and reviewing consultations and minor procedures.

Total number of staff who participated in focus groups and interviews at each site

	Focus groups	Interviews
Site A	Doctors: n = 6 Doctors: n = 5 Nurses: n = 7 Pharmacists: n = 21	-
Site B	Doctors: n = 3 Doctors: n = 17 Pharmacists: n = 15	-
Site C	-	-
Site D	-	1 Pharmacist
Site E	Pharmacists: n = 11	-
Site F	Doctors: n = 11 Nurses: n = 6 Pharmacists: n = 5	-
Primary care	GPs: n = 4 GPs: n = 4	4 GPs

Interview Guide - Hospital Staff

Current medicine review

1. Can you describe the current process of medicine review?
2. What normally happens during medicine review?
3. Do you think medicine review is done well? Why/why not?
4. Can you think of anything that would help you review medicines more quickly or easily?

Polypharmacy and deprescribing

5. What is your understanding of polypharmacy and deprescribing?
6. Do you think polypharmacy is a problem in older inpatients?
7. Can you think of any ways to reduce inappropriate polypharmacy in hospital?
8. Are there any drugs that are harder or easier to deprescribe in hospital?

Decision support

9. What information do you think the decision support should convey?
10. Who do think that decision support should be directed to?
11. Where and when would it be most useful?
12. Do you think decision support should target complex or common situations?

Interview Guide - General Practitioners

Current medicine review for your patients during hospital admission

1. Can you describe the medicine reviews that occur for your patients in the hospital?
2. Do you think medicine review in hospital is done well? Why/why not?
3. Do you think medicine review in hospital is communicated well to you? What is the best way to communicate medicine changes to you?
4. How active would you like to be in the decision making process when changes are made to patients admitted to hospital?
5. Can you think of anything that would improve medicine review for your patients admitted to hospital?

Polypharmacy and deprescribing

6. What is your understanding of polypharmacy and deprescribing?
7. Do you think polypharmacy should be reviewed during hospital admission? Why/why not?
8. How do you think information about polypharmacy and deprescribing should be communicated to you on discharge?

Decision support on discharge to improve continuity of medication management after review in hospital

9. We are designing protocols to guide continuity of medicine changes made during hospital review on discharge. What information do you think the decision support tool should convey?
10. What type of decision support would be most effective?

Standards for Reporting Qualitative Research (SRQR) - checklist

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