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## REPORT

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Translating dementia research into practice

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## ***Background***

The elderly are particularly prone to adverse drug reactions. Inappropriate medication use in the elderly appears to be common and is an important and potentially avoidable cause of adverse drug reactions and hospitalisation. The Beers criteria are the most widely used criteria for assessing the appropriateness of medication use in the elderly, but its dichotomy of 'appropriate' and 'potentially inappropriate' medications has been criticised for a lack of appreciation of the context of prescribing. Patients with dementia are particularly vulnerable to medication adverse effects including cognitive effects of medications with anticholinergic properties.

## ***Methods***

This was a qualitative study of Australian GPs employing semi-structured interviews and thematic analysis. GP participants of an RCT of an educational intervention who had study participant patients taking at least one Potentially Inappropriate Medication (PIM) were invited to participate.

## ***Results***

Twenty-two GPs from four regions in three states participated. While none were aware of the Beers criteria, participant GPs generally displayed good knowledge of the potential adverse effects of Beers Criteria medications. They were comfortable in the continued prescription of the medications. This was based on often quite complex harm-benefit considerations for individual medications in the biopsychosocial contexts of individual patients. An area, however, where participants had less appreciation of potential medication adverse effects was that of 'anti-cholinergic load' – the cumulative burden of anticholinergic effects in patients' medication regimens which is particularly problematic in patients with dementia or cognitive impairment.

## ***Conclusions***

The concept of 'appropriate' versus 'inappropriate' medications implicit in classification systems such as the Beers Criteria is at odds with complex considerations given by GPs to decisions around prescribing of PIMs in the elderly. GPs' approaches to potentially harmful medications are framed in a biopsychosocial context that can't be encapsulated in a dichotomous classification.

## Introduction

In any 2-week period, medication has been taken by more than 90% of the elderly Australian population.<sup>1</sup> The elderly are particularly prone to adverse drug reactions, with reactions responsible for up to 30% of Australian hospital admissions for patients over the age of 75.<sup>1</sup> Inappropriate medication use in the elderly appears to be common<sup>2</sup> and has been established as an important and potentially avoidable cause of adverse drug reactions and hospitalisation in the aged.<sup>2,3</sup> An Australian study of older veterans and war widows found that 28% were using at least one medication deemed by the Department of Veterans' Affairs to be 'often or usually inappropriate'.<sup>4</sup> This raises the question around the determination of appropriate versus inappropriate medications in the elderly, given that both may result in adverse drug reactions and adverse outcomes.

There are a number of criteria for assessing the appropriateness of drug prescription / medication use in the elderly. The Beers criteria<sup>5</sup> is the most widely used. This has been used internationally<sup>3</sup> and in Australia.<sup>6</sup> Originally formulated in 1991 for nursing home residents through an extensive process of literature review and a modified Delphi technique, the Beers criteria for potentially inappropriate medication use in community-dwelling older adults was formulated in 1994 and updated in 2003.<sup>5</sup> The criteria specify inappropriate medications for all elderly patients, and inappropriate medications considering patient diagnoses or conditions, including dementia.

Though the Beers criteria are framed as defining "potentially inappropriate" medications, studies employing them (or other comparable criteria) do not take into account contextual factors that might distinguish "potentially" from "actually" inappropriate prescribing, and often report their findings simply as "inappropriate prescribing".<sup>7</sup> The Beers and other measures of "inappropriateness" of prescribing depend upon pharmacological criteria and do not incorporate the patient's views and other contextual factors.<sup>8-10</sup> Nor do they account for physiological and clinical differences between individual patients – particularly important in this situation as variability of these parameters within populations increases with age.<sup>11</sup> Classification systems such as the Beers criteria can thus be seen to dichotomise prescribing as "appropriate" or "inappropriate" (and, hence, "good" or "bad") without a consideration of the interplay of scientific and contextual aspects operating in the consultation.<sup>8</sup>

A recognition of the complexity of this issue and the role of contextual issues is of importance. Considerable effort and resources are being directed at education measures for general practitioners in order to modify their prescribing patterns so as to reduce their prescription of "inappropriate medications".<sup>12</sup> So far, data in this area has related to a simplistic premise that certain medications are inappropriate in the elderly without consideration of the context of prescription. It is unlikely that GPs will engage fully with educational initiatives in this area that do not recognise the practical complexities of the issue.

A further consideration is that a group of elderly patients in which inappropriate medication use is of particular concern is patients with dementia. The central nervous system is the most common site of action of Potentially Inappropriate Medications (PIMs) in the elderly<sup>13</sup> and these medications may further impair compromised cognitive function. In a Swedish community-based study of inappropriate medications, subjects with dementia were more likely than non-demented subjects to be exposed to neurological and anticholinergic medications.<sup>14</sup> Antipsychotic medications were the principal contributor to both these classes of medications in subjects with dementia. In a Scottish community-based study, patients with dementia were significantly more likely than patients without dementia to be prescribed antipsychotic drug drugs, antidepressants and hypnotic/anxiolytics.<sup>15</sup>

Medications with anticholinergic properties are singularly problematic in the elderly, and many of the drugs on the Beers list have anticholinergic effects. Medicines commonly used in the elderly and which have appreciable anticholinergic effects include gastrointestinal antispasmodics, antipsychotic medicines, tricyclic antidepressants (which are often used in older patients for pain modulation and urinary incontinence rather than depression), medications which reduce urinary urge incontinence, and antihistamines.<sup>16 17</sup> The anticholinergic effect may be intrinsic to the purpose for which the medication is used (such as when treating bladder overactivity or gastrointestinal motility) or may be an unintended effect.<sup>17</sup> Anticholinergic effects of different medicines taken concurrently may be additive, constituting “anticholinergic burden”<sup>18 19</sup> of an individual’s medicine regimen.

In Australia, inappropriate prescribing has been examined in elderly populations of veterans and war widows,<sup>4 6</sup> but not among the wider elderly population (who access a different pharmaceutical benefits scheme) and there have been no qualitative studies or studies considering the perspective of the clinicians who prescribe the potentially inappropriate medications.

The aim of this study was to explore potentially inappropriate prescribing by Australian GPs by examining the context of potentially inappropriate medication use in community-dwelling elderly patients. The effect of some PIMs on cognitive function was a particular area for exploration.

## **Methods**

This was a qualitative study employing semi-structured interviews with Australian GPs.

The respondents in the study were GPs recruited from the “Detection and Management of Dementia in General Practice” project, a randomised controlled trial of an educational intervention for GPs conducted in three Australian states. The methodology of that study is described fully elsewhere.<sup>20</sup> Briefly, as part of that study, study nurses conducted individual interviews in the homes of (patient) participants, all of who were aged 75 years or older. The medications currently being taken by patient participants (including over-the-counter and herbal or complementary medications) were recorded.

For the current study, the ‘Beers criteria’ was adapted to the formulary of drugs available in Australia by using MIMS online<sup>21</sup> to produce a list of PIMs appropriate to the Australian context. This list was applied to the medication lists of patient participants to produce a list of GPs of patients in who PIMs were being used at the time of interview. From this list of GPs, maximum variation sampling - seeking male and female respondents, GPs from four different Australian regions, and from practices of varying size – was used to prioritize GPs to invite to participate.

Identified GPs were invited to take part in phone interviews regarding the use of the particular PIMs taken by their participating patient and their approaches to prescribing PIMs in general. The GPs were informed of the particular patient/s and the particular medication that had prompted their invitation into the study and encouraged to consult the patients’ notes to confirm that the medication was, indeed, prescribed (and by whom) and to familiarize themselves with the circumstances in which the medication had been prescribed.

The interviews were either tape recorded and transcribed verbatim or, at the participant’s request, notes were taken during the interview. Interview summary sheets were completed during each interview by the interviewer.

Data analysis was concurrent with data collection, allowing ideas and themes to emerge from the data and exploring these themes in subsequent interviews. Data collection continued until thematic saturation had been achieved. During this iterative concurrent analytic-data collection approach, a provisional codebook was developed. This codebook was applied to transcripts as data collection continued using a process of constant

comparison. This iterative thematic analysis highlighted emerging themes and informed the conduct of subsequent interviews. A final codebook, following the achievement of thematic saturation and the conclusion of interviews/data collection, was then formulated and applied to all transcripts. Segments of transcripts were grouped according to this coding schema and were then re-read to establish relationships of individual codes to each other and an overall interpretation of the data. Interviews and analyses were performed by a single investigator (PM).

## **Results**

Twenty-two interviews were conducted, with GPs in three states of Australia, from April 2009 to July 2010. Twenty-one interviews were audiotaped and transcribed. For one interview, the interviewer took notes during the interview including verbatim quotations.

Thirteen of the respondents were male. After confirming with the GP if the identified Beers criteria medications (including dosage considerations for some medications) had been prescribed, there were 38 patients identified, all except two of who were prescribed one Beers criteria medication. Two patients had been prescribed two Beers criteria medications each. There were 14 patients prescribed a total of 15 Beers Criteria medications with strong anticholinergic properties.

Beers Criteria PIMs identified in the study are listed in Box 1.

**Box 1. Beers criteria medications being taken by participating patients of participating GPs.**

Alprazolam >2mg/day

Amiodarone

Amitryptilline

Dexchlorpheniramine

Diazepam

Digoxin > 0.125mg/day

Doxepin

Ferrous Sulphate > 325mg/day

Indomethacin

Methyl-dopa

Naproxen

Nitrofurantoin

Oxybutynin

Piroxicam

Propantheline

Propoxyphene

*Knowledge and awareness of potential adverse effects of PIMs.*

While no respondents had heard of the Beers criteria (or were aware of any other formalized lists of potentially problematic or inappropriate medications in the elderly), they identified a range of potential adverse effects of the individual PIMS medications that their patients were taking. For example: sedation, confusion, addiction, falls and fractures with benzodiazepines; digoxin's potential to cause toxicity in the elderly, especially those with reduced renal function; depression with methyl dopa; gastrointestinal toxicity, renal impairment and fluid retention with non-steroidal anti-inflammatory medications. Generally respondents were well-aware of the potential adverse effects of the PIMS that they prescribed.

An area, though, where knowledge of potential adverse effects was not as complete was the anti-cholinergic effects on cognition of some PIMs. Respondents were very aware of the common anti-cholinergic adverse effects of medications such as tricyclics and continence medications – dry mouth, blurred vision, prostatism and constipation. These adverse effects are readily apparent to the patient and thus easily monitored.

I'm most aware of is, causing constipation and sometimes a dry mouth. (Respondent number 2)

Respondents were also aware of cardiac effects of anticholinergic medications such as tricyclics. Sedation was also widely recognised as a potential side-effect of tricyclics.

The dry mouth side effects and bladder problems can be a common sort of problem.... cardiac things and... sedation and all that sort of stuff. (Respondent 16)

This awareness of potential sedative effects of drugs with anticholinergic properties was, in many respondents, associated with an appreciation of the propensity of anticholinergic medications to cause confusion and worsen cognition.

You can get dry mouth from it, it can increase your falls and confusion. They're the main things that I would be aware about. (Respondent 15)

I'd try and avoid [tricyclics for pain in the elderly]. I use nothing in those people because their confusion is going to be such a major problem (Respondent 16)

The particular need for caution in patients with dementia was often appreciated.

If they had dementia, of course, it's [anticholinergic medication] not a good idea. (Respondent 18)

But while many respondents recognized the cognitive effects, not all did.

I know it [propranolol] can cause dry mouth and things like that ... and the constipation but [I was] unaware of cognitive effects in a patient with dementia [until a patient had their propranolol] ceased in hospital... It's something I'm more aware of now... Some of the things like dry mouth and things like that you know they complain of, they're the main things that people actually complain of with it, that's about the only thing [I was previously aware of]. (Respondent 8)



While the potential adverse effects of anticholinergic medications were, overall, well recognized (though the cognitive effects were not universally recognized), only one respondent identified additive anticholinergic effects of different medications ('anticholinergic load') as being something that they considered in prescribing in the elderly.

I suppose if they're [patients on anticholinergic medications] on other medications we might be a bit concerned about [and review the] medication list and see which ones have potential anticholinergic effects. (Respondent 18)

Thus, with some caveats around anticholinergic load and cognition, the GP respondents in this study had good appreciation of the potential for harm of the PIMS medications their patients were taking. But, obviously, their patients were still prescribed these medications. Respondents were confident in their prescription of the identified PIMs and reported being comfortable with continuing their prescription.

### *Harm-benefit decisions regarding the use of PIMs*

Given that the GP respondents were aware of the potential for harm of the PIMS medications, initiation or continued prescription in any individual scenario was found to be a result of a reasoned weighing of harms and benefits.

As a practitioner you have to feel confident that you make a considered judgement on the basis of the clinical situation plus the risks. (Respondent 19)

Each time you write the script, I suppose I really review the rationale behind using it. (Respondent 20)

An important facet of this weighing of risks and benefits was that the assessment had to be individualized taking into account the singular circumstances of a particular patient.

All trials are a sort of a pooled data situation, and there will be individuals for whom a particular medication works well and may still be appropriate. I think we deal with an individual and a person sitting in front of us and try and juggle things ... I don't think they [guidelines like the Beers criteria] should ever be rigid ones because that doesn't fit the reality. (Respondent 1)

A number of factors may have been involved in harm-benefit decisions around initial prescribing. Both the potential severity and the likelihood of occurrence of the adverse effect had to be taken into account, as did the degree of benefit likely to be obtained (which was, in part, related to the severity of the problem being treated). This equation might be modulated by patient co-morbidities.

You've got a description from the patient, an idea of how big the problem is, [and] we don't expect the drugs to be completely safe, and we're trying to weigh up whether the risks of drugs are justified by the size of the benefit we're looking for. (Respondent 2)

And you know if they've got multiple pathologies and brain stuff going on, or drink a lot of alcohol [that must be considered]. (Respondent 20)

If they had severe [urinary] symptoms, you'd have to balance it [use of anticholinergic PIMs] on an individual basis. (Respondent 18)

Pharmacological side-effects might even be a positive factor in harm-benefit analyses.

You know the person with diarrhoea you might end up giving a constipating one and the agitated person you might give a sedating one. (Respondent 10)

Risk stratification of potential harm could be conducted for some PIMs prior to commencement of therapy and, once a PIM was being used, monitoring of side-effects could be instituted.

Before I start anybody [on NSAIDs] I always check their renal function make sure their eGFR is good. (Respondent 18)

[For a patient on an NSAID] check their renal function, cardiac function, see if they're on the triple whammy stuff like an ACE and a diuretic as well. .... A lot of these people are on PPIs, so that makes me feel more comfortable. [So I] watch their renal function..... The other thing too you have to watch is their blood pressure. (Respondent 20)

A consideration in monitoring was that some adverse effects are evident and easily monitored, while others (including some serious effects) may be unpredictable in onset or not easily monitored. But another perspective was that evident or overt adverse effects (compared to covert potential harms) may be a legitimate focus for harm-benefit calculations in this elderly population if quality of life was the paramount consideration in patients' and GPs' decision-making schemas.

But in the elderly, you tend to do less prevention and more quality of life kind of stuff... these [Beers] criteria are about preventing less likely but more serious side effects. (Respondent 1)

For example, while NSAIDs might be thought problematic in the management of osteoarthritis:

Sometimes it just makes a big difference in their life. You know they say I can knit, I can use my hands, I can walk and I know when I'm not using it [the NSAID]. (Respondent 20)

But these harm-benefit decisions were not seen as being easy. The example of potential for cognitive adverse effects versus control of urinary incontinence was cited by several respondents as typifying this decision-making difficulty.

Incontinence makes life pretty miserable, so that's a fairly large quality of life basis, I think that's a big problem and so I'm prepared to take more risks to solve a continence problem, than something that was less distressing to the patient. So, I don't know how at what proportion of patients are going to suffer a cognition problem from it and I guess if he seemed to be finding it hard to think, while he was taking it, then we'd review it. (Respondent 2)

[It's] whether you think it's worthwhile risking the potential side effect as to make the her feel more comfortable and get a better night sleep and not be rushing off to the toilet all the time. (Respondent 15)

The major identified difficulty in the assessment of risk and benefit in this scenario was that the potential harms may not be as immediately apparent as the benefits.

Falls can be intermittent and cognition can be subtle and so, in terms of quality of life, you want sort of pretty decent benefit to justify use of these things [anticholinergics in urinary incontinence]. (Respondent 21)

Incorporating quality of life considerations in therapeutic decision-making was closely linked to the involvement of patients and families in the decision-making processes. This included eliciting patients' and their families' preferences and taking account of pragmatic issues such as medication costs.

Ditropan's on the PBS... they have to pay a private script [for] Vesicare... when choosing between drugs price would be a factor. (Respondent 15)

The environmental context of the PIMs use (for example nursing homes or hostels as opposed to the patient's home) may also influence harm-benefit calculations - for example, by effect on access to non-drug alternative management strategies.

An inpatient in an institution, we could probably manage [cessation of benzodiazepines] a little bit better. Respondent (13)

A major difficulty for GPs in risk stratification was the heterogeneous nature of potential adverse effects and the lack of formal means of weighting severity and likelihood of potential adverse effects relative to potential therapeutic benefits.

We've got no quantification of the risk. So, if a drug has a side effect that happens to one in a hundred patients, it's very different if it happens to one in three patients. And especially if it's a difficult to quantify problem -- such as, impairing their balance, you might get a little bit of balance impairment or you might get a whole lot of balance impairment, so if it causes mild balance impairment on everybody who takes it, that's pretty serious. I don't have any gauge of how sizable and serious some of these things are. (Respondent 2)

If they're important -- and I guess that's where this business of having a quantification of probability and severity, it would be most helpful, 'cause then you know what's on that side of the scales. (Respondent 2)

Thus, harm-benefit calculations were qualitative. They might also involve weighing of differential effects of PIMs at varying dosage rather than simple all-or-none considerations of potential harm.

So you know probably I wouldn't be as worried giving someone with a mild cognitive defect 10 mgs of tryptanol if they're, if they had significant pain issues which would probably impact on their cognitive function anyway. (Respondent 1)

#### *The difficulty of ceasing as opposed to initiating PIMs.*

Many of the individual instances of PIMs among their patients' drug regimens that prompted invitation of GPs to participate in this study were not initiated by the respondent GPs. For these medications, in particular, they perceived problems in medication cessation. The most commonly cited example was long-acting benzodiazepines. Respondents were universally reluctant to initiate benzodiazepines in the elderly.

I generally wouldn't use it in this age group ... I can't even remember when I last initiated [as opposed to continuing] Valium for anyone. (Respondent 20)

But benzodiazepine cessation was seen as a difficult outcome to achieve.

Little old people are often quite fixated in what they need or what they want. I mean the bigger, bigger problem, as you'd know, is with the benzos. (Respondent 15)

It's almost like trying to take a bone away from a dog. (Respondent 16)

Each time you try and broach it with them [benzodiazepine cessation] you do the same dance and end up back at the same spot. (Respondent 6)

A common response was to take a conservative approach, deferring any attempt to intervene and cease PIMs till the circumstances were most favourable for obtaining patient engagement.

When people first come, I don't usually go OK well we need to stop this, this, this, this and this. I mean, you've got to gain some sort of confidence that you know what you are doing. (Respondent 8)

Another frequent scenario was of PIMs initiated by specialists. GPs felt that these were very difficult for them to cease.

[PIMs] may be prescribed by a specialist ...if something has been ordered by a specialist it's, it's a bit difficult... being a general practitioner to then say 'well, I don't think I want that'. (Respondent 11)

Another situation identified as being problematic was that of patients who didn't have a 'personal' GP that they attended on an ongoing basis. Such a lack of continuity of care was seen as a barrier to decision-making around medication cessation.

The situation was also raised of the patient long-established on a PIM with apparent efficacy but whose harm-benefit equation, with the passing of years, is becoming less favourable. The example was cited of patients on incontinence medications becoming more susceptible with each passing year to anticholinergic cognitive effects.

What medications you should stop, and when. You know it would be lovely, it would be lovely to pare back [medication lists] - we've got so many people that are on a long list of medications that have just accumulated over the years... when do you call it quits? (Respondent 8)

#### *Automated alerts of potentially inappropriate medications in the elderly*

Most respondents felt it may be useful to have a facility in their practice patient notes software to alert or 'red flag' PIMs when prescribed in those over a certain age.

I suppose if you had something, and this patient's over the recommended age for this medication that would probably be a reasonable thing. (Respondent 1)

Some respondents, though, were averse to using automated flagging mechanisms.

Some of them are extremely irritating you know. (Respondent 6)

I must admit then I have a fairly low threshold for not pursuing flags. (Respondent 5)

But, recognizing both the possible utility of automatic flagging and the potential for 'alert fatigue', some respondents felt a more limited application would be appropriate.

Look, I think that sort of thing would be useful, and I guess it depends on what the inclusion/exclusion criteria on that was. And I guess the other useful thing about the utility would be if you could switch the button off. So, if you were confident about what you were prescribing, that every time you open a patients records that it didn't necessarily pop up. (Respondent 3)

Perhaps if you had a thing which asks you would you like to do your annual medication review on the Beers criteria so you perhaps didn't want it to come up every time, but at a regular interval. Or, that it was part of the over 75's check that you could just activate that for it. (Respondent 4)

If it could be brief so we're not reading through too much stuff. (Respondent 14)

## Discussion

### *Principal findings*

In this study we explored GPs' knowledge of, and attitudes to, prescribing of PIMs in the elderly. Despite GPs respondents not having heard of the Beers criteria, we found good awareness by GPs of potential adverse effects of individual PIMs. While there was incomplete knowledge around the cognitive effects of medications with anticholinergic properties and limited appreciation of anticholinergic load, overall appreciation of adverse effects was sound and was the substrate for quite complex decision-making.

Decision-making, even in these medications with acknowledged potential for harm, relied as heavily on potential benefits of medication as on potential adverse effects. While respondents recognized the increased potential for adverse drug reactions with increasing age, they also felt that age may also bring a shift in the relative weights assigned in harm-benefit equations to symptomatic benefits (weight enhanced) and unlikely but serious adverse effects (weight decreased). Thus, quality of life considerations were seen as being paramount in many prescribing decisions in the elderly and patient (and relative) perspectives were seen as central to assessing relative weights of potential harms and benefits.

In this, respondents' views reflected opinions in the literature that criteria such as the Beers, being drug-orientated or disease-oriented and not encompassing clinical judgment, or the quality of life, societal and family-related contexts of prescribing,<sup>10</sup> cannot adequately reflect overall prescribing quality. Also, our respondents felt that, with increasing patient age, symptomatic improvement and quality of life considerations were more prominent in their decision-making than potentially serious but unlikely toxicities. This view has also been expressed by Spinewell et al: 'goals of treatment might change, and social and economic factors might be different or more important for these patients than for a younger population'.<sup>10</sup>

GPs in this study found stopping PIMs more difficult than avoiding their initial prescription. In particular, they found cessation of medications initially prescribed by specialists to be difficult. This finding may be problematic as it is likely that GPs, as generalists, will have particular capacity to make complex decisions around prescribing, weighing harms and benefits within a psychosocial context, compared to sub-specialists. The circumstance of anticholinergic burden of an individual's medication regimen is a particular example. The multiple medications that contribute to anticholinergic burden in an individual patient may

have been prescribed by many doctors, often sub-specialists. But it is the GP (as the principal clinician in the patient's care and the co-ordinator of overall care) who is responsible for evaluating anticholinergic burden, and weighing adverse effects of individual medications against efficacy in the context of the overall well-being of the patient. Despite this central role, GPs respondents in this study often felt difficulty in ceasing medications commenced by sub-specialists. The reluctance of GPs to cease medications initiated by secondary care doctors has been proposed as a possible cause of psychoactive medications initially prescribed in the three months prior to nursing home admission being less likely to be ceased than psychoactive medications prescribed more than three months before, or after, admission.<sup>22</sup>

### *Strengths and limitations of the study*

A strength of the study was that we invited GPs to participate who were known to have at least one elderly patient prescribed a Beers criteria medication. Thus, our interviews had face validity by involving GPs who were currently managing patients receiving Beers criteria medications. Furthermore, while the interview was concerned with the use in the elderly of medications (especially Beers criteria medications) generally, the discussion was focused by initially considering the pros and cons of a particular medication that had been prescribed to one of their patients. Another strength of the study was in recruiting from four centres in three states, thus providing a broad range of GP experience.

A limitation of the study was that, as in all qualitative research, our sample frame was not representative or our sample generalisable. Rather, we recruited on the basis of a maximum variation sample - seeking male and female respondents, GPs from four different Australian regions, and from practices of varying size. While maximum variation sampling is the optimal sampling strategy for a study of this kind, one consequence in this case is that those GPs who agreed to participate may well have occupied the higher end of the spectrum of clinical competency and confidence. This is possible as, firstly, there may well be such a response bias in the GPs in the larger RCT from which our GP participants were recruited. Secondly, in this study we were asking GPs to discuss their clinical management and decision-making in the context of having been identified as having patients prescribed potentially inappropriate medications. It is reasonable to assume that responders were confident in their clinical acumen and judgement. Thus, our findings of good levels of knowledge of clinical aspects of prescribing in the elderly and our having demonstrated complex and contextual decision-making must be interpreted in the light of this and of Scottish research that suggests there is a fourfold variation between GP practices (not explained by structural characteristics of the practices) in rates of high risk prescribing to vulnerable patients (including the elderly).<sup>23</sup>

### *Implications for practice*

An implication of these findings is that dichotomous lists of potentially inappropriate medications based on pharmacological properties of the drug, plus or minus a limited number of patient morbidities, are inadequate to capture the complexity of clinical decisions and the social contexts in which they are made. While this view has also been expressed previously, it does not mean that the Beers criteria are not of clinical utility. While finding strict adherence to any guideline as clinically limiting and not in patients' interest, respondents felt that the Beers criteria might be a valuable 'red flag' or 'alerting' mechanism. While they generally felt that an alerting system in their prescribing software might be a positive factor in patient safety, they were cautious about the potential for 'alert fatigue' inherent in any such system.<sup>24</sup> Alerting systems are likely to need to be more complex and flexible than simple 'red flags' prompted by prescription of a drug from a set list.

A further finding was that some of our GP respondents suggested that an ability to better quantify subtle adverse drug effects such as cognitive effects would be clinically useful. In this situation, a prescribing software alert to prompt the quantification of cognitive performance (for example, with a Minimental State Exam or other measure) at prescription and re-prescription to an elderly patient of a medication with significant anticholinergic properties might enable tracking of any change in cognition with use of the medication.

Given the findings of this study, a further recommendation would be for the development of tools for calculation of patients' medication regimen cholinergic loads. Means of calculating cholinergic load are extant,<sup>25</sup> but to be clinically useful for GPs these would need to be incorporated in GP clinical software.

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