Doctors' perspectives on the barriers to appropriate prescribing in older hospitalized patients: a qualitative study

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WHAT IS ALREADY KNOWN ABOUT THIS SUBJECT?

- Potentially inappropriate prescribing (PIP) is a significant problem in the older population.
- PIP is associated with many negative outcomes, including the occurrence of adverse drug events (ADEs) and hospitalization.
- While much research has explored the prevalence of PIP, little work has been done to identify why it occurs.

WHAT THIS STUDY ADDS

- Doctors feel they do not receive sufficient training in prescribing for older patients.
- Doctors are aware that PIP occurs but often feel forced to prescribe even though they know it may be inappropriate.
- Interventions to address PIP will have to be multi-faceted.

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Keywords

inappropriate, older patients, potentially, prescribing, qualitative

Received

13 August 2014

Accepted

12 November 2014

Accepted Article

Published Online

18 November 2014

AIMS

Older patients commonly suffer from multimorbidities and take multiple medications. As a result, these patients are more vulnerable to potentially inappropriate prescribing (PIP). PIP in older patients may result in adverse drug events (ADEs) and hospitalizations. However, little has been done to identify why PIP occurs. The objectives of this study were (i) to identify hospital doctors' perceptions as to why PIP occurs, (ii) to identify the barriers to addressing the issues identified and (iii) to determine which intervention types would be best suited to improving prescribing.

METHODS

Semi-structured interviews based on the Theoretical Domains Framework (TDF), a tool used to apply behaviour change theories, were conducted with 22 hospital doctors. Content analysis was conducted to identify domains of the TDF that could be targeted to improve prescribing for older people. These domains were then mapped to the behaviour change wheel to identify possible intervention types.

RESULTS

Content analysis identified five of the 12 domains in the TDF as relevant: (i) environmental context and resources, (ii) knowledge, (iii) skills, (iv) social influences and (v) memory/attention and decision processes. Using the behaviour change wheel, the types of interventions deemed suitable were those based on training and environmental restructuring.

CONCLUSION

This study shows that doctors feel there is insufficient emphasis on geriatric pharmacotherapy in their undergraduate/postgraduate training. An intervention providing supplementary training, with particular emphasis on decision processes and dealing with social influences would be justified. This study has, however, uncovered many areas for potential intervention in the future.

Introduction

It is a well-known phenomenon that the population is ageing globally. Recent projections estimate that by 2018, there will be more people over the age of 65 years than there will children under 5 years worldwide [1]. By 2040, 1.3 billion people will be over 65 years of age, an increase from the current 7% of the worlds' population to 14% [1]. Advances in diagnostics, treatment, and in healthy living initiatives are largely responsible for this population growth [1]. The prescribing of multiple medications for multiple disease states, is common amongst older individuals, and these patients are therefore more vulnerable to medication related problems, including potentially inappropriate prescribing (PIP) [2, 3]. PIP is defined as either the prescribing of a medicine that carries more risk than benefit, especially when there is a safer alternative, or the omission of a medicine that would be of benefit to the patient [2–6]. Studies conducted in Ireland and continental Europe show that PIP is a significant problem, with prevalence rates of 20%, 58% and 70% reported in primary, secondary and tertiary care, respectively [7–11]. PIP is associated with many negative outcomes, including the occurrence of adverse drug events (ADEs) and hospitalization, and consequently places a large economic strain on the health care system and intangible costs on individuals.

Whilst it is acknowledged in the literature that PIP is an issue requiring significant attention, little qualitative research has been conducted into why PIP occurs. Indeed, studies investigating PIP have traditionally focused on the individual medicines or pharmacological class of medicines that are inappropriately prescribed [12–17].

Behavioural change is key to any intervention requiring improvement in clinical practice. Behaviour change interventions can be modelled on any number of evidence-based theories that exist within health psychology [18, 19]. However, with so many to choose from, there is always doubt as to whether the model chosen fully accounts for the behaviour in question. A solution has been presented for this problem. An overarching theoretical framework, combining 128 constructs from 33 theories of behaviour change was developed by Michie *et al.* [20]. The resultant framework, known as the 'Theoretical Domains Framework' (TDF) consists of 12 'theoretical domains'. These domains serve as potential mediators of change.

In the UK, the PROTECT study (PRescribing Outcomes for Trainee doctors Engaged in Clinical Training) investigated the prevalence and causes of prescribing errors made by junior doctors. As part of this, Duncan *et al.* used the TDF to explore the factors that influence junior doctors' prescribing behaviour [21]. They found seven domains to be likely mediators of change and using previously published methods [22], suggested several behaviour change techniques likely to be useful in an intervention study [21]. Similarly, in order to implement changes in current prescribing practice for older people, it

is necessary to identify the processes leading to the prescribing of inappropriate medicines. Further examination of the barriers and facilitators to these processes will allow for effective implementation of prescribing improvement interventions.

The aims of this study were using the TDF, (i) to explore hospital doctors' perceptions as to why PIP occurs, (ii) to identify the barriers to addressing the issues identified, thus identifying potential targets for intervention and (iii) to use the behaviour change wheel to determine which intervention types would be best suited.

Methods

Sampling

In Ireland, there are three types of hospitals, (i) public hospitals, owned and funded by the Health Service Executive (HSE), (ii) voluntary hospitals, which are run by voluntary/private boards who receive money from the government to provide health care services and (iii) private hospitals who receive no state funding. Hospitals were purposively selected to ensure a range of hospital type were included in the study, large HSE, small HSE, large voluntary and small voluntary.

A sampling matrix was designed to ensure our participant sample was representative of doctors prescribing for older people in the hospital setting and represented doctors working in both geriatrics and in general medicine. The matrix ensured we interviewed an equal number of doctors of each grade, both from geriatrics and general medicine, and from each hospital.

Convenience sampling was then used to identify study participants within the hospitals. The chosen hospitals, in the Munster region of Ireland, were contacted and asked if they would take part in the study. The chief hospital pharmacist was the point of contact in all hospitals, and approached hospital doctors on our behalf. They were provided with a written description of the study's background, aims and methods, and were asked to pass this information to hospital consultants. Consultants were asked if they would make themselves and their team available for a 25–30 min one-on-one interview. The primary researcher (SC) then followed up with an e-mail within 1 week of the initial contact by the chief pharmacist. Consultants willing to participate approached each member of their team informing them of the study and provided details of those team members who were willing to participate in the research. Doctors were excluded if they were working in surgery involved in research related/similar to this study (currently or in the past), or they had a pharmacy degree prior to undertaking their medical training.

Data collection

Semi-structured interview topic guides were formulated by the research team based on the TDF. The original 12

domain TDF was used [20], due to its proven track record and use in similar studies [20, 21, 23, 24]. The interview schedule was then piloted with three health care professionals and amended accordingly.

Semi-structured interviews were the preferred method of data collection as it is well established that semi-structured interviews tend to delve deeper into the core of a subject and elicit more meaningful responses from participants [25].

The purpose of the topic guide was to explore the 12 domains of the TDF, while also allowing participants to speak freely, unlimited by strict questions. It has been shown that interviews based on the TDF elicit responses from participants that would not otherwise be reported [26].

Participants were briefed about the study and reassured that all interviews would be anonymized. Demographic details were collected before the interview, including grade, gender, number of years working as a doctor, his/her current speciality, details of any specific training in geriatric medicine they may have received and university attended. Interviews were audio-recorded and later transcribed verbatim. They were also asked some general questions regarding their knowledge and awareness of PIP.

Interview locations included a private hospital office used for various research projects, consultants' private offices, hospital canteens and doctors' lounges. All locations were on hospital grounds to minimize disruption to participants.

Data analysis

A similar approach adopted by Duncan *et al.* [21] was followed for this study as a similar behaviour was being described i.e. prescribing. All transcripts were inputted into QSR NVivo® Version 10 to facilitate analysis. Analysis was conducted in two phases. Phase 1 was a familiarization phase, where transcripts were read and re-read to ensure that researchers were familiar with the entire content of all transcripts [27]. In phase 2, conventional content analysis [28] was conducted independently by two researchers (SC and AF). In conventional content analysis, the researchers identified themes within the transcripts, and coded all subsequent texts to these themes as they arose. Findings were compared and differences resolved through further discussion, analysis and consensus [29].

Directed content analysis [28] was then employed to apply the TDF and identify relevant domains. In directed content analysis, unlike conventional, texts were coded to a pre-defined list of domains or research findings. Using the TDF helps to define a behaviour and identify barriers and facilitators to that behaviour. The TDF has been employed in a wide range of health care related research to inform better future intervention [21, 23, 24] and has since been expanded to 14 domains [30]. Once domains

within the TDF are identified, they can be mapped to suitable intervention types using the 'behaviour change wheel', a previously published technique also developed by Michie *et al.* [31]. A domain was deemed relevant if text from the interview transcripts was frequently coded into that domain *and* participants suggested that constructs within the domain were an influencing factor in PIP. Again, the domains identified as relevant were agreed upon by two researchers (SC and AF). The behaviour change wheel [31] was then used to identify intervention types that would be suitable, given the domains identified.

The authors decided to use two forms of content analysis to ensure that all relevant themes were identified. For the purposes of the study and identifying domains to be targeted in a future intervention, the directed content analysis was to be the primary data source. The conventional content analysis was to be used to identify other, less critical areas of interest that may arise but not fit directly into the TDF.

Ethics approval for this study was sought from and granted by the Clinical Research Ethics Committee in University College Cork, Republic of Ireland.

Results

All doctors approached to take part, did so and a total of 22 interviews were conducted.

Four hospitals took part, two HSE and two voluntary (one large and one small of each), as well as all grades of doctor (Table 1). Thematic saturation was reached after 18

Table 1

Participant characteristics

Hospitals	Total number of participants from each	Grades of participants	Total number of participants working in geriatrics	Gender
Large HSE	6	2 Intern 2 SHO 2 Reg 1 Consultant	2	3 Male 3 Female
Small HSE	5	1 Intern 2 SHO 1 Reg 1 Consultant	3	3 Male 2 Female
Large voluntary	6	1 Intern 2 SHO 1 Reg 2 Consultant	3	4 Male 2 Female
Small voluntary	5	1 Intern 1 SHO 1 Reg 1 Consultant	2	2 Male 3 Female

Intern 1st year as qualified doctor; SHO: Senior House Officer (Next stage after Intern); Registrar (Reg) Next stage after SHO.

interviews but another four were carried out to ensure no new themes were emerging, as per the Francis method [32].

As mentioned above, the topic guide used for the interviews was designed to explore the domains of the TDF. However it also included some questions designed to provide a cross-sectional picture of doctors' awareness of PIP and prescribing in general for older patients. Some points of interest from these questions follow. (i) When asked to estimate what they thought the prevalence of PIP in hospitals was, the vast majority guessed above 50%. (ii) When asked if they thought it was a problem that needed addressing, all but one felt it was. (iii) When asked where they thought PIP might be most prevalent, primary, secondary or tertiary care 14 felt it was highest in primary care, (where it has actually been shown to be lowest (7–11)). (iv) When asked to rate their confidence in prescribing for older patients on a scale of 1–10 (10 being the most confident), over half placed it at between 5 and 6. These were all interns and senior house officers (SHOs). (v) When asked if they were aware of any screening tools to aid prescribing for older patients, only the consultants were able to name the common ones. The other participants, for the most part had heard of them but had no idea what they were.

Approximately half the doctors interviewed were, at time of interview, working in geriatrics (Table 1), with the remaining in other medical specialties or general medicine. The vast majority of doctors in geriatrics mentioned, without prompting or direct questioning on the matter, that prescribing within geriatrics is in general, far more appropriate than in other medical specialties they have experienced. There was a common trend within this group that more exposure to geriatricians would be of great benefit to prescribing in older patients, and this was also echoed by doctors not currently in geriatrics.

Conventional content analysis

Following familiarization, and open coding, four overarching themes, contributing to PIP were identified. They were;

- More education required in area of geriatric pharmacotherapy.
- Prescribing environment is conducive to PIP,
- Poor information technology (IT) infrastructure,
- Lack of collaboration between levels of care,

Directed content analysis

To identify relevant domains in the TDF that could be targeted in an intervention, directed content analysis was employed. In all, five domains were identified as relevant; environmental context and resources, memory/attention and decision processes, knowledge, skills and social influences. These same domains were identified from both the geriatricians' interview transcripts and those not working

in geriatrics. Behaviour regulation and beliefs about capabilities were also identified at an early stage. However, although purported to in some interviews, they were not indicated as being a significant contributory factor in PIP. How each of the five relevant domains were represented is presented below. Knowledge and skills are presented together as participants made little distinction between the two. More quotes supporting the different domains are presented in Table 2.

Environmental context and resources The environment in which doctors prescribe was noted throughout the interviews, with interviewees reporting that the circumstances in which they prescribe create an atmosphere conducive to PIP. In particular, their workload, being interrupted while writing prescriptions and a lack of supportive IT infrastructure within their working environment, were considered conducive to PIP. They identified the multidisciplinary team structure as a definite facilitator to appropriate prescribing, but indicated that its impact is hampered by inefficient use of the resources within this team.

'That's a major problem. What you want to do when you're writing out a drugs kardex [prescription chart], is to be on your own, to be left alone, for 5 min while you just write out the thing. But it's actually an ideal opportunity for anybody who wants a piece of you for advice or whatever, (. . .) nobody respects that at all, and nursing staff will use it as an opportunity to unload multiple other problems' **Site 1, interview 6 (Intern)**

A theme evident throughout many of the interviews was that of resources available, with particular emphasis on the lack of IT infrastructure. Interviewees noted that improvements and developments in the IT infrastructure could lead to much safer and more appropriate prescribing, with many doctors emphasizing that prioritizing improvement initiatives around IT infrastructure could have the most significant impact.

'Part of the reason (for PIP) is there isn't a very good interface between the electronic systems that they [GPs] use and the electronic systems that we use. So in an ideal world the GPs should be able to electronically send in all up to date information.' **Site 3, interview 2 (Consultant)**.

A further issue raised by the interviewees, was the team support within the hospital environment. Particularly, the hospital pharmacist was considered a useful team member and a reliable resource. However, interviewees felt that the pharmacist's input was not used to full effect, with many not having regular pharmacist input. Some interviewees also noted that the way in

Table 2

Supporting quotes from interviews

TDF domain and intervention types identified as suitable by the behavior change wheel	Supporting quotes
1. Environmental context and resources Behaviour change wheel interventions identified: -Environmental re-structuring -Persuasion -Incentivization	<p><i>'I do think though, it's a tough job, it really is very tough, you're just flat out busy all the time, I think a lot of times you're just transcribing things you just go into auto pilot and you transcribe things that have already been prescribed and you don't question it.'</i> Site 3, interview 1 (Intern)</p> <p><i>'We should have open access computers on every ward for resources including BNFs and other sorts of policy documents, antimicrobial policy and other things you use all the time. And these are all barriers, if you're unsure about checking the medication, these are all barriers that will put a lazy person off um, checking it. I think it's really important that we have better access to IT on every ward. It's really terrible at the moment.'</i> Site 1, interview 6 (Intern)</p> <p><i>'I think it [improved IT infrastructure] is a resource that would be potentially brilliant for drug and prescribing management, in general. How could I give you a better example of that now. . . .I think let's say in community, in retail pharmacy, there are platforms available which off the bat [straight away], will flag drug–drug interactions, as you fill a script, and it's up to the pharmacist to look at it. We don't have anything like that, and it would be so easy.'</i> Site 1, interview 6 (Intern)</p> <p><i>'In New Zealand we had a pharmacist for every team in the hospital who used to go around and check all the meds and they were very much part of the medical team and we took a lot of advice from them because they had more time to go through them [the medicines prescribed]. I know like the culture here is kind of, that we [prescribers] are in charge of meds, but that was one thing that was brill, and it wasn't just a green thing on the front of the chart, they would go through every admission, which was a big job, but they would go through every patient and go on the ward round, and they would have a medical idea of why the patient was in and recommend changes to the medications. I thought that was very good. The team didn't have to take the advice. Pharmacists are better at that kind of thing so I think that would be a really good idea'</i> Site 1, interview 1 (Reg)</p> <p><i>'I think that actually, I do think pharmacists have helped me an awful lot this year. Like things like pointing out drug interactions that you mightn't have noticed (. . .) definitely find the pharmacist really helpful so I don't mind them ringing me and their notes are great on the kardexes [prescription chart] and stuff. And it's especially helpful if there's something the patient can't remember.'</i> Site 4, interview 6 (Intern)</p> <p><i>'Well we don't have clinical pharmacy involvement here, which hopefully it's going to start and that's a great thing you know it improves our prescribing overall.'</i> Site 4, interview 3 (Consultant)</p>
2. Memory/attention and decision processes Behaviour change wheel interventions identified: -Enablement -Modelling	<p><i>'You know sometimes you're writing three or four pages of a drug kardex, and to look at every possible interaction, you know you'd see the common things but the less common things get overlooked all the time.'</i> Site 2, interview 3 (SHO)</p> <p><i>' . . . some people just believe everything the patient says at face value without ever really investigating whether or not they actually know what they are talking about'</i> Site 4, interview 1 (SHO)</p> <p><i>'I think you have to be more thoughtful prescribing for elderly patients and I think a lot of people just do it without taking enough care and stuff like that, you know you have to know what you're prescribing and you do have to be aware of any interactions.'</i> Site 3, interview 2 (Consultant)</p>
3 and 4. Knowledge and skills Behaviour change wheel interventions identified: -Enablement -Modelling	<p><i>'It's a different knowledge set. And it's difficult you know because there isn't a huge amount of data out there, or its not communicated to us very well, I mean we all hear about the randomized controlled trials when new drugs come out, we get info [information] about that but we don't really hear much like, on grand rounds you know, what meds are good or bad in elderly people'</i> Site 1, interview 5 (Reg)</p> <p><i>' . . . as an undergrad, students don't have a tenth of the teaching that they should have, all doctors of all levels will openly put their hand up and say, as an undergrad, they didn't have the teaching so most definitely there should be an increase in what they are teaching in clinical pharmacy, they should have a huge amount more time at undergraduate level for that because it's such a dangerous occupation you know, prescribing, something has to be done about it ya'</i> Site 3, interview 1 (Intern)</p> <p><i>'I think we do need a lot more patient education, I think we do need the patients, not only going home, not only having a prescription, but they have a detailed patient education leaflet, documenting all the drugs they are on, and their purpose, frequency and duration.'</i> Site 2, interview 1 (Consultant)</p>
5. Social influences Behaviour change wheel interventions identified: -Restrictions -Persuasion	<p><i>'there is no doubt that we would come under pressure to prescribe anti- depressants or sleeping tablets from the family members, not just the person and you have to resist that if you think it is inappropriate but you know, the fact that you have to resist it means that sometimes you probably are swayed by it. And similarly there may be a medication that you may be thinking of prescribing and the family say absolutely no, or have huge concerns about it you know if you are iffy about it, that might be enough to dissuade you.'</i> Site 3, interview 2 (Consultant)</p> <p><i>'I'd start with education actually, but its educating patients as well you know. There's a notion out there you know that you go to the doctor, and the outcome of any consultation should be a prescription.'</i> Site 4, interview 4 (Consultant)</p>

which advice from pharmacists was communicated to the prescribers was important, with interviewees favouring face-to-face communication rather than written communication.

' . . . obviously it would be nice to think that every ward would have a pharmacist attached to it reviewing kardexes [prescription charts] and educating (. . .) but there is a feeling that the pharmacist

comes and writes a note for you, but it's not done face to face, and it actually is a bit antagonistic if anything (...) having post-its [notes] stuck on things saying please review this, please review that, we all hate notes, everyone hates it, so I think that could be done better. So more pharmacy input, but more integrated pharmacy input' **Site 3, interview 2 (Consultant)**

Memory/attention and decision processes Participants referred to this domain in two contexts. Firstly, in conjunction with the high pressure environment in which they prescribe and their workload. This environment affects the attention they can give to each patient and their medicines. Their attention is not at the level it would otherwise be.

'Particularly in A&E (accident and emergency) which is where you are doing the core prescribing, trying to determine what they should be on., making decisions about whether to hold things or not, and I mean there are four SHOs (senior house officers) trying to talk you, along with nurses and stuff' **Site 1, interview 1 (Registrar)**

Secondly, several participants suggested doctors' decision-making and the processes surrounding it as a cause of PIP. There was a feeling amongst these participants that there was wide variation in practice amongst doctors, and that some did not go to the lengths required to make an informed decision when prescribing.

'... when they come in, and they don't have a list of their medications, some people inappropriately just write down the dose that they think that they should be on or whatever, which often commonly happens, or a prescription of a patient that just came in on Sunday, had just the medications written with no doses at all (...) so if you're not going to write a dose you probably shouldn't write anything.' **Site 1, interview 1 (Registrar)**

Knowledge/Skills Although separated into two domains in the TDF, participants for the most part eluded to constructs within these domains as a single domain, and thus, we have reported these together. Participants noted a lack of specific education and training in geriatric pharmacotherapy, and also a lack of communication of clinically relevant information with regards to older patients, for example, which drugs to avoid. Interviewees noted that experiential learning is how their prescribing skills and knowledge of issues around prescribing in older people progress. However they felt that this was

not sufficient and that further structured training was required.

'I'd say if there was a kind of a monthly, or periodic review of the literature (...) to kind of put out a newsletter or something, for medications that are found to be obsolete, medications that are found to be harmful, because we see a lot of people on medication that were used 10 or 20 years ago and are no longer in the guidelines and no longer the current practice (...) I think that would be a good idea.' **Site 2, interview 2 (Registrar)**

'I don't think there is enough training for prescribing in older patients. There is no distinction between older patients and the general adult population in the training. You just learn it from practice.' **Site 4, interview 2 (Registrar)**

Patient education was also considered important.

'And even when they bring a list, their knowledge of those meds is not good. And the patient education of his/her own drug therapies is fairly poor. Community wise, nationwide, there is a big area that needs to be addressed in terms of patient education' **Site 2, interview 1 (Consultant)**

Social influences Participants were specifically asked about outside influences that may affect their prescribing and perhaps increase the risk of PIP. The majority of doctors admitted that patients and/or patients' families can influence their prescribing, to the point where the doctor prescribes something he/she is not totally happy with.

'you as a doctor sometimes have, you feel that you have to do something, you get pressurized by either nursing staff, relatives or patients. You have to give them something. So you end up giving something that you are not 100% happy with.' **Site 2, interview 2 (Registrar)**

They did however say that they did not think these choices were putting their patients at any risk due to these choices after weighing the risks and benefits and that the quality of life was a major deciding factor.

'I would like to think that we never prescribe something that we know is wrong or don't prescribe something that we know is right, even if the family has concerns, I do think we can stand our ground and document their concerns and do it (...) I think we are always just thinking about the patient's quality of life (...) but there's no doubt it sways you where it's a grey area' **Site 3, interview 2 (Consultant)**

Barriers to behaviour change

From the above analysis, it can be seen that the main barriers to appropriate prescribing are:

- An environment which is conducive to sub-optimal prescribing
 - Interruptions, lack of IT infrastructure, chaotic surroundings, all combine making it very difficult for the prescriber to give the extra thought required to ensure the older patient's prescription is appropriate.
- Strained resources
 - Lack of targeted pharmacy input on the wards, poor collaboration between different levels of care due to busy schedules and, again, lack of IT infrastructure.
- Lack of specific training
 - Not enough geriatric pharmacotherapy training, particularly for undergraduates. Prescribers feel ill-equipped to prescribe appropriately.
- Poor patient education
 - Patients' knowledge of their own medicines is generally poor and they can often be reluctant to change. This can make adjusting medications difficult for the prescriber.

Behaviour change wheel

Having identified the domains within the TDF [20] that are relevant to PIP, we then used the behaviour change wheel [31] to identify intervention types that would be suitable to address these domains. According to the behaviour change wheel, the types of interventions that would be beneficial in the area of PIP are training, environmental restructuring, restrictions, persuasion, incentivization, modelling and enablement.

Discussion

This is the first study to use a theoretical approach to investigate issues associated with PIP, with interesting findings.

The responses to the general questions at the start of the interviews paint a clear picture. Doctors are aware that PIP is problematic in this age group. Their estimations of its prevalence were quite accurate. However they feel ill-equipped to deal with it and are ill-informed about the measures that already exist to deal with it, illustrated by their widespread lack of awareness of the common screening tools for prescribing in older patients.

The consensus amongst all doctors (not just those in geriatrics) that increased exposure to geriatricians would be of great benefit is an important point. Of course it makes sense that guidance from experienced geriatricians would improve prescribing in older patients, but to hear it from doctors on the ground, who have experienced pre-

scribing within multiple specialities emphasizes this point. It is also of interest that the same TDF domains were identified from the transcripts of doctors working in geriatrics and those not in geriatrics. This is not surprising, however, as doctors from all medical specialties are seeing more and more older patients now and so the challenges to prescribing for these patients are clear to all.

The domains in the TDF identified as relevant provide the details to the picture painted above. It is a well-known fact that a doctor's workplace can be chaotic [33, 34], and so the emergence of 'environmental context and resources' was not unexpected. Improving the environment in which doctors prescribe is not an easy task. However, areas have been highlighted throughout these interviews that could be good starting points, for example, making better use of the resources available, in particular, the hospital pharmacist, perhaps interventions designed to restrict interruptions to doctors while writing prescriptions, or, thinking bigger, improved IT infrastructure would undoubtedly improve prescribing across the board.

The domain of 'memory/attention and decision processes' was strongly intertwined with the domain of 'environmental context and resources'. In an ideal world, with a calm environment and no distractions, prescribing is still a challenging exercise. The complexity of prescribing is well documented. Aronson has identified the need for a wide range of skills and judgment when prescribing, and the increased difficulties when dealing with a vulnerable population [35–37]. Add in the extra stresses the environment brings with it and the exercise becomes significantly more difficult, not only to remember the important information, but to make the right decision. Doctors' indications that decision making processes, particularly when writing prescriptions, vary quite significantly between individuals is a point to consider, and a possible target for intervention. Again, providing an environment more conducive to appropriate prescribing will address this to some extent. However, the interviews also suggest that, perhaps, greater care to standardize doctors' practise should be taken.

'Knowledge' and 'skills' were two clear areas participants felt could be targeted, although for the most part they referred to these domains as one. The majority of interviewees expressed a desire for further training. Those who did not were the most senior doctors i.e. hospital consultants. Not only do they feel they do not receive adequate *specific* geriatric pharmacotherapy training as medical students, but also, there is a perceived lack of communication of the salient points from modern literature and research once they qualify. This, we feel, is the area with the most potential for intervention in terms of feasibility. Pharmacists and clinical pharmacologists are ideally placed to address this issue and equip doctors with the necessary tools to prescribe for older patients. A change in the undergraduate curriculum is also clearly needed, with more emphasis on geriatric pharmacotherapy.

The most unexpected result of the study was the emergence of the domain 'social influences'. Over half the participants, including the majority of consultants, said that they would be, and/or have been influenced by the patient or their family to prescribe in a manner that could be deemed inappropriate, with several doctors using the term '*forced to prescribe*'. Although most added that they still felt they were not putting the patient at risk, this idea of a doctor feeling forced into a decision is worrying. This correlates well with a recent meta-synthesis on PIP, which found that some doctors feel restricted in terms of their abilities to prescribe appropriately due to a combination of factors such as pressure to please the patients and fear of doing harm by changing a patient's medications [38]. Many of them referred to patient education as a solution to this. The area of shared decision making [39] should also be explored as a means to address this issue that doctors have identified as problematic. This would also counteract the traditional paternalistic approach to prescribing which has previously been identified as problematic and contributory to PIP [40]. However, it should also be noted that while doctors admitted to sometimes knowingly prescribing inappropriately, in certain circumstances, they were conscious of paying more heed to the patients' quality of life rather than the appropriateness of their prescription. This is an important consideration as these patients' requirements can be very different from the average adults.

This study has highlighted the specific barriers to change that exist in the area of PIP. The intervention functions identified through use of the behaviour change wheel correlate well with these barriers, in that, interventions based on environmental restructuring and training would certainly seem logical given that three of the four barriers identified fall under 'environment' or 'training'. We can be confident, therefore, that an intervention informed by these techniques would be justified and beneficial.

To date, interventions that reliably counteract PIP in older patients are lacking. O'Connor *et al.* [41] recently conducted a review which suggests four areas of intervention to counteract PIP in this population, namely comprehensive geriatric assessment, medication use review, prescriber education/audit/feedback and computerized prescriber order entry with clinical decision support. The evidence to support any of these interventions to prevent PIP in older patients is weak. Prescriber education interventions to prevent PIP in particular drug classes have been shown to work, e.g. antibiotics, opioid analgesics and antipsychotics [41]. Although the TDF domains were examined and presented individually, there is significant crossover between them. The environmental context of course has an impact on doctors' memory/attention and decision processes, as well as their ability to carry out basic skills. Similarly, a doctors' particular skill set may determine whether or not they are prone to social influ-

ences and whether they allow such pressures to impact on their prescribing. Bearing these crossovers between domains in mind, it is certain that an intervention to address PIP will have to be multifaceted. One of the intervention types identified by the behaviour change wheel is unlikely to result in a significant improvement. A combination of intervention types however would be well justified and, in the authors' opinions, have a high chance of success.

Limitations

Recruitment of participants for this study was largely the responsibility of a third party i.e. the hospital pharmacist. While it served well to have a person known to the medical staff introduce the project, it is preferable that the researcher(s) claim responsibility for recruitment when using qualitative methodologies.

Whilst the sampling matrix was conducted to ensure inclusivity within the hospital setting, this study therefore reflects the barriers encountered by hospital doctors, and is not generalizable to primary care.

The sample size of 22, although acceptable for qualitative research, is small, and as with all qualitative research, the results are therefore not generalizable.

In conclusion, doctors are quite aware that PIP in older patients is a real problem that needs addressing. It seems the causes are a combination of environmental and social factors, compounded by doctors' lack of specific training and education in geriatric pharmacotherapy. This study has identified key areas for targeting of intervention studies in the future, as well as intervention types that should be used.

Competing Interests

All authors have completed the Unified Competing Interest form at http://www.icmje.org/coi_disclosure.pdf (available on request from the corresponding author) and declare SC had grant funding from the Health Research Board of Ireland to cover expenses to deliver a lecture at the European Society of Clinical Pharmacy (ESCP) conference 2013. There are no financial relationships with any organizations that might have an interest in the submitted work in the previous 3 years and no other relationships or activities that could appear to have influenced the submitted work.

The authors would like to acknowledge the staff of each of the hospitals who took part in this study, particularly the chief pharmacists for their support and assistance.

The authors would also like to acknowledge the Health Research Board of Ireland (HRB) for funding this research. Grant number HRA_HSR/2010/14.

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