Preventing medication errors in care homes: Review of Publications
The aim of this review was to collect and collate publications that might help with prevention of medication errors in care homes in the United Kingdom. The objective was to build on the study by Barber et al which attempted to measure the prevalence, causes and potential harm from such medication errors. [1] The focus of the review was on practical solutions to the problem. Consequently, the key research question to be answered was “What information is available that would help with good practice and best care in the medication pathway for residents in UK care homes?” This review therefore did not limit its scope to an assessment of scientific papers only such as would be the case in a systematic review of clinical trial evidence. Rather, it gathered data from a wide range of sources such as: randomized controlled trials; national guidance reports; pamphlets produced by professional associations; and published discussions of good practice for care workers in residential homes for the elderly.

The review was conducted in three parts. The first was a formal literature search to identify all publications that were potentially relevant to the research question. It was acknowledged that although a formal search would be essential it would not identify all publications that might be of use. Therefore, at the same time as the literature search was being conducted research staff contacted members of the Care Home Working Group to access their expertise and knowledge in this field. Through this network a number of publications, academic and non-academic were brought to the attention of the reviewer.

The next stage, was the selection of a final set of publications for inclusion in the summary information tables. This selection was based on explicit inclusion/exclusion criteria which is set out in the methods section. And finally data was extracted in a systematic way so as to collate summary tables of key pieces of data. It was expected that the interested reader would be able to obtain sufficient information from the summary tables and bibliography to allow him/her to access the publication in full in order to decide on its usefulness.
Methods

2.1 Literature search

A comprehensive literature search was conducted with the aim of identifying all potentially relevant material which could assist in preventing medication errors in care homes. Together, a researcher and information specialist conducted searches of electronic databases, reference lists of significant articles and the websites of relevant agencies for potentially relevant publications.

The databases included MEDLINE, Ovid, Embase, the Cochrane Library and Controlled Trials Register, PsychLit, ERIC. All databases were searched from 2000 until July 2010. Search terms included care home, nursing home, residential home, homes for the aged, medications, medicines, prescribing, dispensing, administration, review, reconciliation, residents, and elderly. See Appendix 1 for full search strategies.

As mentioned in the introduction members of the Care Homes working group were contacted and asked about potentially useful published work that they were aware of. References from this source were combined with results from the formal searches.

To be eligible for inclusion, all available material had to:

- be empirical research or reviews
- be guidance on good practice
- be focused on medications for the elderly in the UK care homes, other relevant care settings for the elderly or equivalent settings elsewhere
- be published online or in print form
- be available in abstract, journal article, or full report form
- be available in English
- address the core question noted in the introduction

2.2 Study selection

2.2.1 Study population and setting

On the whole, only studies that enrolled or focused on elderly residents in care homes were included. Studies and reports from the United Kingdom or Europe were included because of the similarity of care homes in these settings: for example, the similarity of funding arrangements. Studies set in US care homes were excluded. Studies of patients in all UK health care settings were considered relevant if the solutions for prevention of medication errors could be transferred to the care home setting: e.g. from a general hospital setting to a care home setting.

Essentially, the above criteria meant that most excluded studies related to care home settings in the United States. However, academic studies published in the US and which are generally accepted as being pertinent to all settings were included e.g. Beers list of potentially inappropriate medication for older people.

2.2.2 Types of studies

Given that this review focused on practical solutions to preventing medication errors, any published study or report relevant to the subject was selected for inclusion. These could include published guidance on good practice, randomized controlled trials that quantified the benefits of specific interventions for preventing errors, or journal articles that discussed ideas or suggestions for reducing or preventing medication administration errors.
2.2.3 Interventions and outcomes of interest

Any intervention that aimed to prevent medication errors in care homes, regardless of where this occurred in the medication pathway, was included. These could relate to interventions in the prescribing, dispensing, administration, and monitoring of medicines. Outcomes could be quantified (e.g. results of a randomized controlled trial) or descriptive (e.g. good practice in medicines handling).

2.3 Data extraction

Given the nature of this review, which was to present practical solutions aimed at preventing medication errors, data extraction was done with the end users in mind. That is, the aim was to inform the reader about the type of publication and very briefly its aim and content. The ultimate focus however was on practical solutions to the problem of medication errors. Therefore, in reports of good practice or guidelines, only those recommendations that referred specifically to preventing errors in medication were highlighted in the final column of the table.

It was thought that by providing the reader with the publication summary, a detailed bibliography and access to an electronic version of the publication where possible, he/she could select publications relevant to their tasks.
3.1 Literature search results

A total of 244 publications (including items of grey literature) were identified as potentially relevant to the review question. In addition, a further 10 publications were identified as potentially relevant after scanning the reference lists of key publications such as systematic reviews. Of the 254 items that were identified, 30 were excluded after a scan of titles and abstracts because they clearly did not meet the inclusion criteria (Figure 1). Full papers were accessed for further evaluation of the remaining 224 items and at that stage a further 155 publications were excluded. Reasons for exclusion included “inappropriate setting” which referred to studies specifically conducted in the United States, and “inappropriate intervention/outcome”. An example of the latter is Detection of psychiatric disorders in elderly medical patients [2], where the outcome of interest was not relevant to this review. In addition, some publications were press releases or brief editorials about complete published reports that were already identified in the review and consequently such publications were labeled “commentary” or “duplicate information”.

A total of 61 publications met the inclusion criteria and of these 24 were UK care home specific (Figure 1). These included reports on best practice [3;4] as well as prospective randomized controlled trials [5;6]. The largest group of UK based publications related to care in the NHS in general (n=24). Seven publications were specifically associated with hospital care: ward based [7] and hospital/ community based [8]. A further six studies had a primary care setting.

3.2 Publications for helping prevent medication errors

In this section results from the data extraction exercise are presented. All included studies/reports/publications are listed first by setting as follows:

1. UK care home setting;
2. UK primary care setting;
3. UK hospital setting;
4. UK all health care settings;
5. Non-UK care home settings;
6. Non-UK other settings;

and within each setting the type of error prevention measure is described as set out in the CHUMS study[1]. That is, medication errors associated with prescribing, dispensing, administration, and monitoring, respectively.

3.2.1 UK care home specific

Publications with quantifiable outcomes for preventing prescription errors

Table 1 presents summaries of nine publications that report quantified outcomes for measures aimed at preventing prescription errors in care homes. Six out of nine studies evaluated medication review interventions, one conducted by General Practitioners[9] and five by pharmacists [5;6;10-12]. Two studies were audits of prescribing with the aim of reducing inappropriate prescribing [13;14], and one study was an RCT aimed at evaluating training and support to care home staff for managing agitated behavior in patients with dementia as an alternative to drug therapy.[15]
papers identified through searches as potentially relevant n=244 + additional publications identified as potentially relevant after scanning reference lists of key papers n=10. Total = 254

Full papers accessed for further evaluation n=224

Did not meet inclusion criteria n=30

Papers meeting inclusion criteria n=64

Did not meet inclusion criteria n=161
Commentary n=5
Inappropriate intervention/outcome n=73 Inappropriate setting n=68
Duplicate information n=13
Not English language n=1
Out of print = 1

Setting is UK n=58
- Care home specific n=25
- Primary care n=5
- Hospital n=9
- NHS in general n=19
Other settings: n=6
- Canada n=1
- International n=2
- Norway n=1
- United States n=1
- Australia n=1

Figure 1: Results from literature search for relevant studies
<table>
<thead>
<tr>
<th>Publication and type</th>
<th>Setting</th>
<th>Type of preventive measure</th>
<th>Aim of preventive measure</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bruce et al 2007[10]. Observation study. No control group.</td>
<td>Nursing Homes Medical Practice in Greater Glasgow.</td>
<td>Dedicated prescribing support pharmacist assigned to review medication and check stocks in nursing homes.</td>
<td>To improve the appropriateness, quality and cost-effectiveness of prescribing through medication reviews.</td>
<td>• 1340 residents (in 40 homes) medications reviewed. • £118,539 savings identified. • Actions taken include: stopping medications, switching medications, starting medications e.g calcium + Vit D to prevent falls. Numbers not reported.</td>
</tr>
<tr>
<td>Crotty 2007[11]. Observation study. No control group.</td>
<td>South Birmingham PCT in care homes with nursing facilities.</td>
<td>Training and support to staff over 10 months re alternatives to drugs for agitated behavior vs. usual care.</td>
<td>To measure cost savings and reduction in waste of medications and clinical interventions.</td>
<td>• 881 residents reviewed. • £118,539 savings identified. • Actions taken include: stopping medications, switching medications, starting medications e.g calcium + Vit D to prevent falls. Numbers not reported.</td>
</tr>
<tr>
<td>Fossey et al 2006[15]. Cluster randomized controlled trial.</td>
<td>12 specialist nursing homes for people with dementia in Newcastle, Oxford and London.</td>
<td>Training and support to staff over 10 months re alternatives to drugs for agitated behavior vs. usual care.</td>
<td>To measure impact on: proportion of patients receiving neuroleptic medication and mean dose; agitation; quality of life; adverse events including falls; irritable behaviour; and proportion taking other psychotropic medication. At 12 months: • 23% taking neuroleptic drugs vs. 42% in control. • Average reduction in neuroleptic use in intervention group= 19.1% (95% Confidence interval 0. 5% to 37.7%). • No difference in agitated or disruptive behavior between groups.</td>
<td></td>
</tr>
<tr>
<td>Furniss et al 2000[12]. Randomised controlled trial.</td>
<td>Nursing homes for older people in Manchester.</td>
<td>Review of medication by a pharmacist vs. no regular review.</td>
<td>To investigate the effect of a review of medication by a pharmacist.</td>
<td>• 330 residents included and 158 in intervention group. • Mean no. of prescribed drugs fell in the intervention group from 5.1 to 4.2 compared to the control group where mean no. fell from 4.9 to 4.4 (p=0.07 for difference between groups). • No difference in agitated or disruptive behavior between groups.</td>
</tr>
<tr>
<td>Khunti and Kinsella 2000 [9]. Observation study. No control group.</td>
<td>Four nursing homes in Leicester.</td>
<td>Systematic review of medication in nursing home by GP(n=109 residents.</td>
<td>To assess the impact of review on consumption of inappropriate drugs in nursing homes.</td>
<td>• 98% were on repeat prescriptions. • 65% of patients had repeat prescriptions altered. • 51% had at least one item stopped. • 26% had at least one item changed. • 7% had new medication prescribed.</td>
</tr>
</tbody>
</table>

Notes: 1. Medication reviews followed principles from Morecambe Bay Primary Care Trust medication review tool kit for over 75’s[16] and Klepping G 2000 [17]. 2. A clinical pharmacist carried out either a level 2 medicines review (with access to the patients notes) or level 3 review of medicines and clinical condition (with access to the patients notes and face-to-face review) on all residents of care homes with nursing. 3. The review took place in the GP’s surgery, in the nursing home or in exceptional circumstances, over the phone.
<table>
<thead>
<tr>
<th>Publication and type</th>
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<th>Aim of preventive measure</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morrison 2009[13]. Audit report of antipsychotic prescribing.</td>
<td>N=81 General Practice patients who live in a nursing home.</td>
<td>Audit with following criteria: a) Is there a clear recorded indication? B) documented review of script in last 6 months? Introduction of review checklist.</td>
<td>To assess whether prescribing of antipsychotic drugs was appropriate.</td>
<td>• 22(27%) were on antipsychotic drugs. • Clear recorded indication in 11 (50%). • Documented review in previous 6 months in 14 (64%). • After introduction of review checklist antipsychotic drugs had fallen to 15 (19% of total 80). • Both audit criteria were met in 100% of cases.</td>
</tr>
<tr>
<td>Oborne 2003[14]. A report of how prescribing indicators from a hospital were modified and applied in a nursing home setting.</td>
<td>22 specialist nursing homes for people with dementia in Newcastle, Oxford and London.</td>
<td>Modified (from hospital setting) prescribing indicators for use in nursing home setting.</td>
<td>To use modified prescribing indicators, to assess appropriateness of prescribing in the nursing home setting.</td>
<td>After an audit of one day's prescribing in 22 nursing homes: • 934 residents were prescribed a mean of 5.1 regular items. • 496/934 (55%) drug sensitivity statements were completed. • Although 24% residents received benzodiazepines, clinical data indicated that only 7% received benzodiazepines appropriately. • Fewer than half residents with atrial fibrillation received appropriate antithrombotic therapy.</td>
</tr>
<tr>
<td>Patterson et al 2010 [5]. Randomised controlled trial.</td>
<td>Nursing homes in Northern Ireland.</td>
<td>Monthly visits x 12 by specially trained pharmacists to do med review using algorithm and working with GPs vs. usual care.</td>
<td>To test the effect of an adapted US model of pharmaceutical care on prescribing of inappropriate psychoactive medications and falls in nursing home residents.</td>
<td>At study end proportion of patients taking inappropriate medication in the intervention group (25/128, 19.5%) was much lower than in the control homes (62/124, 50.0%). Odds ratio=0.26, 95% confidence interval =0.14 to 0.49.</td>
</tr>
<tr>
<td>Zermansky et al 2006 [6]. Randomised controlled trial.</td>
<td>Care homes (n=65) for the elderly in Leeds.</td>
<td>Clinical medication review by a pharmacist. Included a review of clinical record and consultation with GP and patient. Control group received usual GP care.</td>
<td>To measure impact of review on: number of changes in medication per participant, number and cost of repeat medicines, mortality, falls, hosp admissions, GP visits, Barthel index, SMMSE.</td>
<td>• 361/661 (95.2%) patients reviewed vs. 62/330 by GP. • 3.1 drug changes per patient vs. 2.4 in control (p&lt;0.001). • 0.8 falls per patient vs. 1.3 in control group (p&lt;0.001). • No significant difference in deaths, hosp admissions, GP visits, costs, Barthel index or SMMSE. Conclusion: reviews can lead to substantial change in medications without change in costs. Reduction in falls. No significant change in any other outcomes.</td>
</tr>
</tbody>
</table>

SMMSE=Standard Mini-Mental State Examination.
Publications with descriptive outcomes for preventing prescription errors

Table 2 presents summaries of six publications that present discussions and/or recommendations for reducing prescription errors in care homes. One study makes recommendations for reducing prescriptions for antipsychotic medications in care homes [18]. Two studies include specific recommendations about the role of the pharmacist in reviewing and monitoring medication use in care homes with the aim of improving appropriate prescribing [19, 20]. Three studies are general discussion documents about possible ways to prevent medication errors in general [21-23] but with an emphasis on measures to reduce inappropriate prescribing.

Table 2: Publications that describe preventive measures for prescription errors in UK care homes

<table>
<thead>
<tr>
<th>Publication and type</th>
<th>Setting</th>
<th>Aim of preventive measure</th>
<th>Outcomes</th>
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</thead>
</table>
| All-Party Parliamentary Group on Dementia, 2008 [18]. Report of inquiry into prescription of antipsychotic drugs. | UK care homes for older people. | To limit the use of antipsychotic medication in people with dementia. | - Protocols for the prescribing, monitoring and review of antipsychotic medication for people with dementia must be introduced.  
- Creating audit criteria around the NICE-SCIE guideline is strongly suggested and the Care Quality Commission should facilitate this.  
- A national and local audit of the prescription of antipsychotics is required and clarity is needed around who would be best placed to complete this.  
- There must be a NICE appraisal on the cost-effectiveness of prescribing antipsychotic drugs for people with dementia. |
| Cowan D 2002 [21]. Discussion about what community nurses can do to address inappropriate prescribing. | UK care homes for older people | To help community nurses address the problem of inappropriate prescribing. Not drug specific. | Community nurses could:  
- Instigate medication reviews.  
- Undertake ‘first order’ medicine-related-problem (MRP) risk assessment.  
- Provide information to older people and their carers in care homes. |
| Hughes 2007 [22]. Review of adverse drug events and ways to avoid them. | UK care homes for the elderly. | To reduce number of adverse drug events in care homes. | Suggestions included:  
- Finding non-pharmacological approaches to behavior management.  
- Promoting effective and appropriate polypharmacy and reducing inappropriate drugs.  
- Training for care home staff re monitoring of medications.  
- Multidisciplinary working, with greater input from pharmacists.  
- Development of systems that support prescribing, monitoring and care transitions. |
<table>
<thead>
<tr>
<th>Publication and type</th>
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<th>Outcomes</th>
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</table>
| Royal College of General Practitioners (Scotland) and the British Geriatrics Society  | UK Care Homes (Scotland)    | Frailty, older people and care homes, can we do better? Present situation and recommendations for change.           | Medication specific recommendations:  
  • Pharmacy input should be routine for all care homes and should link in with regular medication reviews, also involving primary care input.  
  • Clinical interventions often lead to polypharmacy and the need for a rational approach in terms of prescribing practice is required. |
| Royal College of Physicians 2000 [20]. Report of a joint working party.               | UK Care homes for older people. | To explore options for addressing issues that prevent older people from receiving appropriate services.            | Medication specific recommendation is that: the management of medication and the role of the pharmacist may be enhanced through an institutional approach. In essence a pharmacist may hold a contract for the provision of pharmaceutical services to a care home. Such a contract could include monitoring of prescribing, e.g. sedation and anticoagulation. |
| Maxfield L on behalf of Sandwell NHS Primary Care Trust, 2010 [23]. Service pecification for Nursing homes review team. | Sandwell Primary Care Trust, Nursing homes. Review team consists of geriatrician, pharmacist and senior nurse. | To provide highly specialized review, guidance and support to the independent providers who run care homes. Aim is to ensure a high standard of health care.                                              | Major changes have been in stopping/starting medications. Also, reduction in inaccurate recording, incomplete audit trails, and issues of incorrect medication storage. |
Publications with descriptive outcomes for preventing administration errors in care homes

There were no publications that reported on quantifiable outcomes for measures aimed at reducing the number of medication administration errors in UK Care homes. Table 3 lists nine publications that were identified as providing suggestions and/or recommendations for reducing administration errors. Four of these were discussion documents and drew from a number of different sources in making suggestions about how administration errors might be reduced [24-28]. One publication was formal guidance issued by the Royal Pharmaceutical Society of Great Britain (RPSGB) on handling medicines in social care settings [3]. One review document made proposals for reducing errors based on a small number of studies [29] and two studies were surveys, one of care homes practice [4] and one of issues related to patient adherence to medication [30].

Table 3: Publications that describe measures for preventing administration errors in care homes

<table>
<thead>
<tr>
<th>Publication and type</th>
<th>Setting</th>
<th>Aim of preventive measure</th>
<th>Outcomes</th>
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</table>
| Ashurst 2008 [27]. Discussion of procedures to prevent drug errors in care homes. | UK nursing and residential care homes for the elderly. | To discuss the way in which risk can be minimized and drug errors prevented. | • Actions aimed at reducing errors include:  
  • Putting a photograph of each resident on the Kardex.  
  • Reduction of disturbances to nursing staff doing medicine rounds.  
  • Being consistent with medicine round times.  
  • “Potting up” medicines in advance should be outlawed.  
  • Ensure the medicine administration record is signed.  
  • Regular testing of nurses’ knowledge of medications. |
| Commission for Social Care Inspection (CSCI), 2006 [4]. Follow-up study to measure improvement since 2004. | UK care homes for older people and children’s homes. | To improve medication management. | Care homes with high scores tended to have the following in place:  
  • Good procedures for medicine administration and record keeping.  
  • Written medication policies.  
  • Medication storage.  
  • Review of medication by residents’ GPs. |
| Hinchcliffe 2010 [29]. Review of evidence. | UK care homes for older people. | To reduce administration errors in care homes. | Proposed solutions to help reduce administration errors include:  
  • Support from community pharmacists  
  • Printed MAR charts provided by pharmacy to care homes.  
  • Introducing a ‘Reporting and learning’ vs. blame culture in care homes re errors. |
| Hughes 2009 [30]. Qualitative survey of residents in care homes. | Care homes for older people in Northern Ireland. | To assess adherence to medications in care homes and assess patient involvement in decision making. | Proposed solutions to help reduce administration errors include:  
  • Support from community pharmacists  
  • Printed MAR charts provided by pharmacy to care homes. |
| Lilley 2010 [31]. Toolkit for best practice and accredited learning. | Residential and nursing homes in the UK. | Describes ways to ensure the right medicine is given to the right patient at the right time. Written specifically for care professionals in care homes. | • Speaks to the care home worker.  
  • Asks questions of the reader.  
  • Explains good practice in the care home setting.  
  • Gives straightforward examples of things that work to reduce errors. |
### Table 3 (cont):
Publications that describe measures for preventing administration errors in care homes

<table>
<thead>
<tr>
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</table>
| Nazarko 2007 [24]. Discussion of National Minimum Standards (NMS) on Medication (2004) and some thoughts on how to prevent errors. | Care homes for older people in the UK. | To enable care home staff to understand NMS, be aware of common problems in medication management and manage medication effectively. | **Suggested use of available help:**
  - Downloadable guidance on administration and control of medication by RPS.
  - Where PCTs provide pharmacy support, use it for education and training of staff.
**To reduce administration errors:**
  - Nurses to use Do Not Disturb signs when doing medication rounds.
  - Organize work so that pressure on medication round staff reduced.
  - Encourage self medication by patients who have been assessed as able to do so.
  - Encourage medication reviews. |
| Pountney 2010 [25]. Discussion of best practice in management of meds in care homes. | Care homes for older people in the UK. | How to improve care and reduce drug errors. | **With regard to preventing errors, points made as follows:**
  - Medicines to be handled in accordance with legislation
  - Attention to be paid to NMS by care home staff.
  - Self-administration for residents who are able.
  - Communication and staff training. |
| Royal Pharmaceutical Society Great Britain, 2007 [3]. Guidance on handling medicines in social care settings. | Social care settings in the UK including care homes for older people. | To provide a guide to good practice and current legislation governing the handling of medicines. | **A discussion of legislative issues associated with administering medicines and good practice.** |
| Weaver 2005 [26]. Discussion of the issues involved in care assistant assisting in administering medication. Relates to NVQ Unit X13. | Long-stay care settings in UK. | To address the performance criteria, knowledge evidence related to: legislation, clients taking their own medicine, labeling and staff training. | **To reduce administration errors:**
  - Nurses to use Do Not Disturb signs when doing medication rounds.
  - Organize work so that pressure on medication round staff reduced.
  - Encourage self medication by patients who have been assessed as able to do so.
  - Encourage medication reviews. |

CSCI=Commission for Social Care Inspection (CSCI), GP=General Practitioner, NMS=National Minimum Standards, MAR=Medication Administration Record, RPS=Royal Pharmaceutical Society, PCT=Primary Care Trust.
NMC= Nursing and Midwifery Council. RPSGB=Royal Pharmaceutical Society of Great Britain.
3.2.2 UK primary care setting

Publications with quantifiable outcomes for preventing prescription errors

Table 4 presents summaries of two publications whose aims were to quantify outcomes for interventions aimed at improving prescribing practice and adherence/compliance. One randomised controlled trial [32] was identified which sought to reduce hospital admissions in high-risk elderly patients using home-based community pharmacist medication reviews. A second publication was a web-based audit of Medicines Use Reviews (MUR). Four groups were questioned about their involvement in the MUR: Community Pharmacy, General Practice, Primary Care Organisations (PCO) and patients who recently had a MUR. Results are presented in this publication for NHS Oxfordshire [33].

Publications with descriptive outcomes for preventing prescription errorsin primary care

Table 5 includes 2 studies in a UK primary care setting in which suggestions are given for improving prescribing for the elderly. One is an analysis of patient records aimed at predicting factors associated with potentially inappropriate prescribing. Based on those factors it makes suggestions for improvement [34]. One study considers how best to deliver effective medication reviews in primary care [35].

Publications with descriptive outcomes for preventing administration errrorsin primary care

Table 6 includes one study in a domiciliary care setting that discusses ways in which medication errors in patients’ homes can be minimized [36].
<table>
<thead>
<tr>
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<th>Aim of preventive measure</th>
<th>Outcomes</th>
</tr>
</thead>
</table>
| Lenaghan 2007[32]. Randomised controlled trial. | 136 patients in one GP practice in UK. | Home visits x 2 by community pharmacist: education re taking medications, pharmaceutical care issues, need for adherence aid and liaison with GP re actions. | To reduce non-elective hospital admissions in 6 month period. | • No difference in hospital admissions  
• No difference in care home admissions or deaths.  
• Small decrease in quality of life in intervention group (not significant)  
• Statistically significant reduction in number of medications taken in intervention group (-0.87 items in favour of the intervention group, p=0.03). |

| Kate Holborn for NHS Oxfordshire, 2010 [33]. Results of a national web-based audit of Medicines Use Reviews (MUR) | Community Pharmacy, General Practice, Primary Care Organisations (PCO) and patients who have recently had a MUR. | The MUR set out to: establish patient’s actual use, understanding and experience of taking their medicines; identify, discuss and resolve poor use of medicines; identify side effects that may affect patient compliance; and improve the clinical and cost effectiveness of prescribed medicines. | The aim of the MUR is to improve patient knowledge, concordance and use of medicines. | Key points from local results  
• Patients – 80% felt the MUR was useful, and 95% felt that the questions they raised were answered satisfactorily. The majority (87%) of patients who came away with recommendations said they would make the changes suggested.  
• Pharmacists – 77% of MURs in the study were initiated by the pharmacist, though only 11% met one of the PCT’s MUR priority groups. 78% said they made a recommendation to the patient during the MUR.  
• GPs – 54% stated they considered MUR recommendations. 71% said no meetings had taken place with local pharmacists to discuss MUR provision. 50% of GPs did not see any benefits to the MUR service. |
Table 5: Publications that describe preventive measures for prescription errors in UK primary care.

<table>
<thead>
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</thead>
<tbody>
<tr>
<td>Carey 2008 [34]. Analysis of patient record database</td>
<td>201 General practices in UK.</td>
<td>To predict factors associated with potentially inappropriate prescribing (PIP).</td>
<td>Suggestions in discussion part of paper include use of computerized practice systems to flag up PIP at time a script is issued by GP. Use of age-specific alerts might be most effective.</td>
</tr>
<tr>
<td>Davey 2005[35]. Scoping study of medication reviews delivered through community pharmacist network.</td>
<td>Primary care UK: Primary Organisations, especially relationship between prescribers and community pharmacists.</td>
<td>To scope the opportunity, feasibility and sustainability of medication reviews delivered through the Community Pharmacy network.</td>
<td>Practical issues for delivering medication reviews through community pharmacist network include: • Having comprehensive computer based patient records • Process mapping to overcome problem of variation between practices. • Incremental development of pharmacy led medication reviews. • Pharmacist to develop position of respect and trust with prescribers. • Making financial rewards more evident to General Practice. • Specifying list of triggers for medication reviews e.g. over 65 and on high risk drugs.</td>
</tr>
</tbody>
</table>

GP=General Practitioner, MAR=Medication Administration Record, NSAIDS=non-steroidal anti-inflammatory drugs. PCO=Primary Care Organisations. PIP=Potentially Inappropriate Prescribing. SAP=Single Assessment Process

Table 6: Publications that describe preventive measures for administration errors in UK primary care.

<table>
<thead>
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<th>Outcomes</th>
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<tbody>
<tr>
<td>Multi disciplinary working group in South Tees area. 2010. Model of good practice for safe handling + mgt + administration of medication.</td>
<td>Domiciliary care across NE England.</td>
<td>How to minimize the recurrence of medication errors.</td>
<td>Collect information about errors so that recurring problems are identified and acted on. Learning from errors and ‘near misses’ is a key outcome. • Record on MAR sheet in patient’s home. • Complete incident form. • Document action taken. • Review incident forms on a regular basis to identify recurring themes and inform policy review. • Investigate errors fairly so as not to mask system failures by blaming individual.</td>
</tr>
</tbody>
</table>
3.2.3 UK hospital setting

Publications with quantifiable outcomes for preventing prescription errors

Six publications listed in Table 7 described ways to reduce medication risk to hospital inpatients. One report by the Care Quality Commission was a survey of organizations to find out what they were doing to ensure patient safety when discharged from hospital with a change of medication[8] and a second publication was a companion to the latter document: a self assessment tool kit to help PCTs assess their performance[37]. A National Patient Safety Agency report focused on solutions for medicines reconciliation on admission to hospital [38] and one report by the Royal Pharmaceutical Society provides practical guidance on minimizing medication risks to patients in the transfer/discharge process in hospital[39].

A Patient Safety First Campaign document provided a list of definitions for hospital measures to assess progress of the campaign related to high risk medicines: anticoagulants, opiates, insulin and anaesthetic sedatives[40]. A leaflet (date unknown) was produced by the Royal College of Psychiatrists to highlight the need to audit prescribing of antipsychotics in hospital with specific audit standards given as guidance[41].

Publications with descriptive outcomes for preventing administration errors in NHS hospitals

Three publications (Table 8) for preventing administration errors in hospital are essentially tool kits aimed at providing practical guidance on how to reduce errors during ward drug rounds. One focuses on the acute mental health setting[7] and two relates to NHS hospitals in general [42; 43].
<table>
<thead>
<tr>
<th>Publication and type</th>
<th>Setting</th>
<th>Aim of preventive measure</th>
<th>Outcomes</th>
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</table>
| Care Quality Commission 2009[8]. Report of visits to 12 PCTs, survey of GP practices, analysis of national datasets and exploration of patient experiences. | NHS Hospitals. | A survey of what organizations are doing to ensure patient safety when discharged from hospital with a change of medication. | **PCTs should:**  
- Work with GPs to agree use of standard referral forms.  
- Work with GPs to clarify their expectations of GP practices in relation to reconciliation.  
- Make better use of info they have on GPs’ medicine management performance.  
- Ensure that contracts with acute trusts set out requirements for discharge summaries.  
- Review and set up better monitoring systems to ensure that acute trusts meet obligations on discharge summaries and letters.  
- Evaluate the level of pharmacist support available to them.  
**GPs should:**  
- Ensure they carry out a higher proportion of medication reviews with patient present.  
- Share learning by recording when the medication pathway goes wrong.  
**Community pharmacists should:**  
- Report prescribing errors to PCTS to learn lessons.  
- Ensure that specific patients are offered a medicines use review (MUR).  
**Acute trusts should:**  
- Ensure clinicians are aware of their obligations with regard to admissions and discharge arrangements.  
- Provide data to PCTs re incomplete or late data from GPs.  
- Review medicine management arrangements for Care Quality Commission requirements. |
| Patient Safety First Campaign 2008[44]. A list of definitions for measures to assess progress of campaign related to high risk medicines. | NHS Hospitals. | The campaign is focusing on 4 drugs or drug groups which are representative of high risk medicines: anticoagulants, opiates, insulin and anaesthetic sedatives. | Hospitals can assess their improvement by collecting specific data such as:  
- % of inpatient warfarin doses administered according to protocol  
- Opiate adverse event rate  
- Insulin adverse event rate |
<table>
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| Royal College of Psychiatrists, no date[41]. Leaflet to highlight the need to audit prescribing of antipsychotics. | Adult acute and psychiatric intensive care units (PICU) wards. | To summarise the results of a 12-month quality improvement programme targeted on the prescription of high dose and combined antipsychotics on acute wards. | Audit standards include:  
- The dose of an individual antipsychotic should be within recommended limits.  
- Individuals receive only one antipsychotic at a time.  
- First (typical) and second generation (atypical) antipsychotic drugs are not prescribed concurrently. |
| Royal Pharmaceutical Society et al. 2008 [39]. Good practice guide associated with patients transferring or being discharged from hospital. | NHS acute hospitals UK. | Practical guidance to help multidisciplinary teams maximise good practice and minimise the risks for patients associated with their medicines, in the transfer and discharge process. | Research evidence includes the following key messages:  
- providing community pharmacists with information regarding discharge medication  
- a discharge medication summary given to the patient, their GP and nominated  
- 45% of recommendations made on pharmaceutical care plans were acted on by the GP or community pharmacist.  
- the design of the paperwork (care plan) is important and should be integrated into the electronic communication process.  
- counselling prior to discharge accompanied by written information or reminder charts were effective at improving compliance.  
- pharmacist-written discharge prescriptions result in fewer errors and a high proportion of patients’ own drugs being reused. |

MUR=Medicines use reviews
<table>
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<th>Publication and type</th>
<th>Setting</th>
<th>Aim of preventive measure</th>
<th>Outcomes</th>
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</table>
| Duxbury 2007 [7]. Manual of good practice for administration of medication. | Acute mental health wards in UK hospitals. | The manual is a tool to compliment training and/or used as a guide in practice. | Practical recommendations aimed at preventing administration errors include:  
- Distractions should be avoided or managed with the availability of sufficient staff.  
- Medications should not be left outside of the trolley. For example on shelves or the lower  
- The trolley should be locked at all times when left unattended. (Requirement)  
- Suitable locations to discuss patients’ mental health status and experience of side effects needs some consideration. |
| NHS Institute for Innovation and Improvement 2008 [42]. Documents how the scheduled administration of medicines can be improved on wards, resulting in fewer errors. | NHS hospital wards UK. | A toolkit aimed at:  
- increasing patient safety by reducing errors  
- Ensuring timely administration of medicines  
- improving patient experience  
- Reducing wasted time. | Examples of improvement from other hospitals implementing the productive ward include:  
- The team members responsible for medicine rounds are defined in advance.  
- Senior nurse does not carry out medicines round leaving her/him free for other duties. Patients are prepared and in the position required for their respective drugs.  
- Red tabards gives a signal to staff and patients that the nurse is concentrating on round. Ward is prepared: people, documentation and medicines prepared prior to round.  
- Reduce the impact other ward activities have on the medicines round. |
| Kings College London 2010 [43]. Review of evidence for contribution of interruptions to medication administration errors. | Hospital ward based. | To consider how interruptions to nurses during administration of medication can be reduced. | Interventions to reduce interruptions during medication related tasks include:  
- Use of protocol checklists (not defined).  
- Use of “interruption vests” and “No talk” signage.  
- Creation of a “patient quiet” zone.  
- Education interventions to minimise interruptions (not defined). |
3.2.4 NHS settings non-specific

All publications that discuss prevention of medication errors in the NHS

Table 9 lists 19 publications that are aimed at improving care in NHS organizations, but that do not easily fit into other NHS categories such as care home, primary care or hospital. Many of them focus on reducing inappropriate prescribing but others include a mix of recommendations for safer medicines use including prescribing and administration.

Five of the publications are national guidance documents: for prevention of falls [45], for management of lower urinary tract symptoms[46]; for management of chronic heart failure [47]; for care of older people [48]; and for prevention of delirium[49]. Those sections that have implications for medicines management have been summarised in the table. Separate specific guidance is issued for the improvement of medicines adherence in patients in the NHS [50].

Three publications discuss the ways in which NHS pharmacists can improve prescribing practices and so reduce medication risks in the elderly[51-53].

The remaining nine publications concentrate on safety issues within the NHS. Two are National Patient Safety Agency alerts for managing risks associated with anticoagulants [54] and diamorphine and morphine [55]. Two reports look at unsafe practice in general within NHS organizations and discuss what steps can be taken to minimize it[56;57]. Five documents look at medication-specific safety issues in the NHS and make suggestions and recommendations on how to prevent errors [38;58-61]
Table 9: Publications that describe preventive measures for prescription errors in the NHS

<table>
<thead>
<tr>
<th>Publication and type</th>
<th>Setting</th>
<th>Aim of preventive measure</th>
<th>Outcomes</th>
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</table>
| Denham 1998 [51]. Discussion of the possible role of the pharmacist with regard to older people on drug therapy. | NHS in general. | To list the way in which pharmacists can promote safer prescribing practices by advising doctors and patients. | Suggested role for the pharmacist includes;  
- Advising doctors  
- Providing information sources about drugs  
- Advisory role to patients including home visits  
- Advice to residents of residential and nursing homes. |
| Department of Health 2008 [52]. White paper about the future of pharmacy in England. | NHS in general in England. | This document is part of an overall strategy to ensure safe, effective and more personalized patient care. | Specific points related to preventing medication errors are as follows:  
- The introduction of a discharge booklet at one hospital resulted in a significant drop in all types of medication errors when patients move between primary and secondary care.  
- Pharmacy practice academics, have made major contributions to the understanding of medication errors and their avoidance, use of medicines in care homes, patients' beliefs about their medicines and their medicine-taking behaviour.  
- Automation of dispensing in hospital has been shown to reduce errors.  
- There is evidence of reduction in medication errors and dispensing errors when coding systems are used to match patients to their care.  
- Closed-loop electronic prescribing, automated dispensing and barcode patient identification reduce prescribing and administration errors.  
- Pharmacists can continue to support the Yellow Card Scheme by reporting suspected adverse drug reactions themselves and encouraging members of the public to do so.  
- In one PCT a medicines management scheme (pharmacist and nurse practitioner) resulted in a 7% reduction in hospital admissions, 32% reduction in number of falls and 60% reduction in number of fractures. |
| Glare J 2010 [58]. A literature review of hospital admissions related to medications. | Primary care prescribing that results in hospitalization (due to serious adverse events). | To describe the interventions that have been shown to reduce the risk of medication adverse events. | Specific points about effective interventions are as follows:  
- Audit Commission recommended increased electronic prescribing and automated dispensing systems to reduce risk of errors.  
- Improving medicines reconciliation have the potential to reduce subsequent re-admissions.  
- Increased pharmacist input can reduce medication adverse events. |
| Grant 2002 [53]. National clinical audit of evidence-based prescribing for older people. | General Practice, Secondary Care and Nursing Homes in England and Wales. | To support improvements in prescribing and medication use in people 65 years and over. | As well as describing national data collection the audit also lists:  
- Indicators of unnecessary/potentially harmful prescribing  
- Clinical indicators of appropriate prescribing.  
- Quality improvement/intervention strategies. |
Table 9 (cont): Publications that describe preventive measures for prescription errors in the NHS

<table>
<thead>
<tr>
<th>Publication and type</th>
<th>Setting</th>
<th>Aim of preventive measure</th>
<th>Outcomes</th>
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</table>
| House of Commons Health Committee 2009 [56]. | NHS institutions. | To explore the key means of establishing a culture and systems capable of addressing unsafe care whatever form it takes. | Specific points made about how to prevent medication errors include:  
• Need to move away from blame culture to wider and better use of root-cause analysis, with a view to preventing repetition of incidents.  
• Need to decriminalise dispensing errors on the part of pharmacists.  
• Need for National Reporting and Learning System (NRLS) data to be published, with data broken down by individual NHS organisation.  
• Need to develop reporting systems that are appropriate to different specialties (e.g. General Practice and anaesthesia).  
• Need to use robot/barcodes in dispensing and administration of medicines which has been proven to reduce the level of medication errors overall.  
• Need to introduce root-cause analysis to staff in the NHS especially in medical student training to put across the message that “nobody is perfect”. |
| National Institute for Clinical Excellence, 2004 [45]. Guideline for assessment and prevention of falls in older people. | Primary and secondary care settings, UK. | This clinical guideline will advise on the effective evidence-based management of LUTS in men. | Recommendations related to medications specifically are:  
• Review current medication, including herbal and over-the-counter medicines, to identify drugs that may be contributing to the problem.  
• Consider medications that can cause nocturnal polyuria symptoms including calcium channel blockers, diuretics, selective serotonin reuptake inhibitors (SSRI) antidepressants. |
| National Institute for Clinical Excellence, 2010 [46]. Guideline for management of lower urinary tract symptoms (LUTS) in men. | Primary and secondary care settings, UK. | This clinical guideline will advise on the effective evidence-based management of LUTS in men. | Recommendations related to medications specifically are:  
• Review current medication, including herbal and over-the-counter medicines, to identify drugs that may be contributing to the problem.  
• Consider medications that can cause nocturnal polyuria symptoms including calcium channel blockers, diuretics, selective serotonin reuptake inhibitors (SSRI) antidepressants. |
| National Collaborating Centre for Primary Care, 2009 [50]. Guideline on medicines adherence, involving patients in decisions about prescribing and supporting adherence. | Primary and secondary care settings, UK. | To give recommendations to clinicians and others on how to involve adults and carers in decisions about prescribed medicine. | Specific recommendations are set out for patient involvement in decisions about medicines under the headings:  
• Communication  
• Increasing patient involvement  
• Understanding the patients beliefs, knowledge and concerns about medicines  
• Providing information  
Recommendations are also made regarding good communication between healthcare professionals in order to ensure that fragmentation of care does not occur. |
Table 9 (cont): Publications that describe preventive measures for prescription errors in the NHS

<table>
<thead>
<tr>
<th>Publication and type</th>
<th>Setting</th>
<th>Aim of preventive measure</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Institute of Clinical Excellence, 2010 [49]. Guidance on the diagnosis, prevention and management of delirium.</td>
<td>Primary and secondary care settings, UK.</td>
<td>To offer best practice advice on the prevention of delirium in adults in hospital or long-term care who are at risk of delirium, and on the care of adults in hospital or long-term care who develop delirium.</td>
<td>A key recommendation among interventions to prevent delirium is: • Carry out a medication review for people taking multiple drugs, taking into account both the type and number of medications.</td>
</tr>
<tr>
<td>National Patient Safety Agency (NPSA), 2007[38]. A review of medication incidents reported to the Reporting and Learning System (RLS).</td>
<td>Primary and secondary care settings in England and Wales.</td>
<td>To help providers of NHS care improve patient safety.</td>
<td>Action points on how to reduce medication incidents are given for different NHS settings. Primary care organisations should seek to contribute to national learning from medication incidents by improving incident reporting in all locations. Actions in relation to specific areas of medication-related risk should include a review of processes for the accurate and timely transfer of medication-related information across all interfaces, but in particular in conjunction with the acute sector.</td>
</tr>
<tr>
<td>National Prescribing Centre, 2010 [62]. A 2-page 5 minute guide series on medication errors.</td>
<td>Primary and secondary care settings, UK.</td>
<td>To provide a brief introduction to medication errors in the wider context of patient safety.</td>
<td>The National Patient Safety Agency has produced a seven step plan to reduce medication errors. 1. Increase reporting and learning from medication incidents 2. Implement NPSA safer medication practice recommendations 3. Improve staff skills and competences 4. Minimise dosing errors 5. Ensure medicines are not omitted 6. Ensure the correct medicines are given to the correct patients 7. Document patients’ medicine allergy status</td>
</tr>
<tr>
<td>NICE clinical guideline on management of chronic heart failure (CHF) in adults [47].</td>
<td>Primary and secondary care settings in UK.</td>
<td>Offers evidence-based advice on the care and treatment of people with chronic heart failure.</td>
<td>Recommendations that are directly relevant to medication use in older people are as follows: • Dosing regimens should be kept as simple as possible. • Tolerance of drugs may be lower and side effects require closer and more frequent monitoring in older patients. • Beta-blockers and ACE inhibitors should be used as first-line treatment for all adults with CHF due to left ventricular systolic function (LVSD) (some sub-groups e.g. older adults, tend to be undertreated with beta-blockers). • All patients with CHF require monitoring including clinical assessment, review of medication and specific blood tests.</td>
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## Table 9 (cont): Publications that describe preventive measures for prescription errors in the NHS

<table>
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<tr>
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<th>Aim of preventive measure</th>
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</table>
| West Midlands Strategic Health Authority, 2010 [60]. Quality, Innovation, Productivity, and Prevention (QIPP) in the NHS. A report detailing how medicines management will be improved within the QIPP framework. | Primary and secondary care settings in the West Midlands. | The aim of the West Midlands programme is to optimise the use of medicines and thereby improve medication safety, reduce avoidable costs and improve medicines adherence. | The report describes the actions that will need to be planned in order to achieve the following objectives:  
  - to eradicate all preventable hospital admissions resulting from sub-optimal medicines use (HARMs) by 2014  
  - to increase the proportion of people who obtain optimal benefit from prescribed medicines by reducing medication errors by 50% by 2014  
  - to improve medicines adherence and thereby improve health outcomes and reduce waste by reducing levels of non-adherence to medicines by 10% by 2014 |
| Nursing and Midwifery Council UK, 2010 [61]. Standards for medicines management to be followed by registered nurses, midwives and specialist community public health nurses. | Primary and secondary care settings, UK. | To set standards for safe practice in the management and administration of medicines. | Standard 24 details the action to be taken in the event of an administration error or incident:  
  - Prevent harm to the patient and report as soon as possible so that the event can be investigated and improvements can take place.  
Standard 25 details the action to be taken in the event of an adverse reaction to a drug by a patient:  
  - Record in the patient’s notes and notify the prescriber  
  - Notify via the Yellow Card Scheme immediately. |
| NHS National Patient Safety Agency (NPSA) 2006[55]. Alert from the National Reporting and Learning Service (NRLS) about actions that can make diamorphine and morphine safer. | All healthcare organizations in UK. | To alert NHS to review and improve measures for safer practice in prescribing, storing, administering and identifying high dose morphine and diamorphine injections. | Actions for the NHS:  
  - Risk assess and have procedures for safely prescribing, labelling, supplying, storing, preparing and administering diamorphine and morphine injections.  
  - Review therapeutic guidelines for the use of diamorphine and morphine injectable products for patients requiring acute care, including post-administration observation of patients who have not previously received doses of opiates.  
  - Update information concerning the safe use of diamorphine and morphine injectable products as part of an ongoing programme of training for healthcare staff on medication practice.  
  - Ensure that naloxone injection, an antidote to opiate-induced respiratory depression, is available in all clinical locations where diamorphine and morphine injections are stored or administered. |
Table 9 (cont): Publications that describe preventive measures for prescription errors in the NHS

<table>
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<tr>
<th>Publication and type</th>
<th>Setting</th>
<th>Aim of preventive measure</th>
<th>Outcomes</th>
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</table>
| NHS National Patient Safety Agency (NPSA), 2011 [54]. Alert from the National Reporting and Learning Service (NRLS) about actions that can make anticoagulant therapy safer. | All healthcare organizations in UK. | To advise healthcare organisations to take steps to manage the risks associated with the prescribing, dispensing and administering of anticoagulants. | Healthcare organisations in England and Wales should:  
- Ensure staff are properly trained.  
- Review and/or update written procedures and clinical protocols to ensure they reflect safe practice.  
- Audit anticoagulant services using BSH/NPSA safety indicators as part of the annual medicines management audit programme.  
- Ensure that patients prescribed anticoagulants receive appropriate information.  
- Promote safe practice for prescribers and pharmacists to check that patients’ blood clotting (International Normalised Ratio, INR) is monitored regularly and that the INR level is safe before issuing or dispensing repeat prescriptions for oral anticoagulants.  
- Promote safe practice for prescribers co-prescribing one or more clinically significant interacting medicines for patients already on oral anticoagulants: arrange for additional INR blood tests and inform the anticoagulant service that an interacting medicine has been prescribed.  
- Ensure that patients prescribed anticoagulants receive appropriate information.  
- Promote the use of written safe practice procedures for the administration of anticoagulants in social care settings. |
| Department of Health, 2000 [57]. Report of an expert group on learning from adverse events in the NHS. | All healthcare organizations in UK. | To examine the extent to which the NHS currently has the capacity to learn from incidents and service failures, and to recommend steps which might be taken to help ensure that similar events can be avoided in the future. | The NHS needs to develop:  
- Unified mechanisms for reporting and analysis when things go wrong;  
- A more open culture, in which errors or service failures can be reported and discussed;  
- Mechanisms for ensuring that, where lessons are identified, the necessary changes are put into practice;  
- A much wider appreciation of the value of the system approach in preventing, analysing and learning from errors. |
### Table 9 (cont): Publications that describe preventive measures for prescription errors in the NHS

<table>
<thead>
<tr>
<th>Publication and type</th>
<th>Setting</th>
<th>Aim of preventive measure</th>
<th>Outcomes</th>
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</thead>
<tbody>
<tr>
<td>Department of Health, 2001[48]. Report on implementing medicine-related aspects of the National Service Framework for older people.</td>
<td>All healthcare organizations in UK.</td>
<td>To ensure that older people: • gain the maximum benefit from their medication to maintain or increase their quality and duration of life. • do not suffer unnecessarily from illness caused by excessive, inappropriate, or inadequate consumption of medicines.</td>
<td>Details of five effective interventions are set out under the following headings: • Prescribing advice/support • Active monitoring of treatment • Review of repeat prescribing systems • Medication review (with individual clients and their carers) • Education and training</td>
</tr>
<tr>
<td>Care Quality Commission, 2010[59]. Report about what providers should do to comply with the regulations of the Health and Social Care Act 2008.</td>
<td>All health and adults social care services in the UK.</td>
<td>To help providers of health and adult social care to comply with the Health and Social Care Act 2008 (Regulated Activities) Regulations 2010 and the Care Quality Commission (Registration) Regulations 2009.</td>
<td>Regulation 13 of the Health and Social Care Act 2008 is related to medicines management. Providers who comply with the regulation will: • Handle medicines safely, securely and appropriately. • Ensure that medicines are prescribed and given by people safely. • Follow published guidance about how to use medicines safely. With regard to all care, in relation to making sure people who use services are not harmed as a result of unsafe care, the provider must have a system to continuously identify, analyse and review risks, adverse events, incidents, errors and near misses.</td>
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3.2.5 Non-UK settings

Publications from non-UK countries that may be relevant to the UK care home setting

Table 10 lists six studies from other countries that may be of interest to those working to reduce medication errors in UK care homes. Three are systematic reviews of the literature. One with an Australia focus, assesses the impact of medication review on psychotropic drug use in long-term facilities [63]. The second is a systematic review of interventions that could be used to reduce potentially inappropriate use of medicines in nursing homes [64] and the third, with a Belgium focus, is a systematic review of interventions involving pharmacists in improving prescribing in care homes [65].

One Canadian study is a discussion about improving recognition and management of delirium in the elderly and focuses on the drugs that might cause delirium as well as making suggestions for medication reviews [66].

One study from the United States is an update of the Beers criteria for potentially inappropriate medication use in older people and it identifies 48 individual medications or classes of medication that should be avoided in older adults [67]. One study from Australia is a test of an instrument called the Drug Burden Index which may be a useful tool for assessing the effects of a medication review on medication use [68].
<table>
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<th>Setting</th>
<th>Aim of preventive measure</th>
<th>Outcomes</th>
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</table>
| Alagiakrishnan 2004 [66]. A discussion about preventing drug induced delirium in the elderly. | Canada. | To improve recognition and management of drug induced delirium. | As well as providing a list of drugs that might cause delirium the following suggested approach to drug-induced delirium includes the following:  
  - Review all the medications and look for a temporal relationship.  
  - Review medications for a recent addition of a new drug or an increase in dosage of medication.  
  - Stop/taper the medication causing delirium. |
| Fick 2003 [67]. A report on the updating of the Beers criteria for potentially inappropriate medication use in older adults. | United States. | To revise and update the Beers criteria for potentially inappropriate medication use in adults 65 years and older in the United States. | This study identified 48 individual medications or classes of medications to avoid in older adults and their potential concerns and 20 diseases/conditions and medications to be avoided in older adults with these conditions. |
| Nishtala 2009 [68]. A quantitative (retrospective review) study of the impact of medication reviews on the drug burden index (DBI) in aged-care homes. | Australia care homes. | To examine the impact of reviews on DBI. DBI is a tool that associates medication exposure with functional outcomes and provides guidance to prescribers for identifying drugs that should be reduced or eliminated to minimize drug-related risks. | A statistically significant decrease (p < 0.001) in median DBI score was observed as a result of uptake of pharmacist recommendations by the GP. DBI may be a useful tool for assessing the effects of a medication review on medication use. |
| Nishtala 2008 [63]. Literature review to assess impact of medication reviews on psychotropic prescribing. | International studies but review had an Australian focus. | To evaluate the evidence pertaining to the impact of medication reviews and/or educational interventions on psychotropic drug use in long-term care facilities. | The pooled odds ratio (OR) from five studies on hypnotic prescribing showed a decrease in use postintervention (OR = 0.57, 95% confidence intervals [CI] = 0.41-0.79). Medication reviews and/or educational interventions are effective at reducing psychotropic drug prescribing. |
| Olive D 2011 [64]. A review of evidence about interventions to reduce use of specific drugs in nursing homes. | International studies but review had Norway focus. | To identify, assess and compile available scientific evidence about the effect of interventions that could be used to reduce potentially inappropriate use of medicines in nursing homes. | The review indicates that interventions using educational outreach, on-site education given along or as part of an intervention package and pharmacist medication review under certain circumstances may reduce inappropriate drug use in nursing homes. This review is an update of a Norwegian systematic review in Norwegian commissioned by the Norwegian Directorate of Health. |
Table 10 (cont): Publications that describe preventive measures for prescription errors

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<tbody>
<tr>
<td>Verrue 2009 [65]. A systematic review of pharmacist interventions to optimize medication use in nursing homes.</td>
<td>International studies. Authors based in Belgium.</td>
<td>To collect and interpret the results of clinical studies of interventions involving pharmacists aimed at improving the quality of prescribing in nursing homes, and to identify the key elements for a successful intervention.</td>
<td>The review shows that the available evidence is mixed concerning the effectiveness of interventions by pharmacists on pharmacotherapy in the nursing home setting. At the same time, greater pharmacist involvement has been shown in published studies to increase physicians’ and nurses’ knowledge and awareness about medication.</td>
</tr>
</tbody>
</table>
A total of 254 publications were identified that were relevant to the review question “What information is available that would help with good practice and best care in the medication pathway for residents in UK care homes?”. The publications that were identified were a result of a combined planned literature search, requests from colleagues within the Care Homes Working Group and discussions with other experts in the field.

Of the publications that were identified, 64 met the inclusion criteria. In short these were associated with either UK care home settings, UK health care settings that could be adapted to the care home setting (e.g. NHS in general or hospital settings) or care home settings in other countries whose organizations were similar to the UK. The 66 publications were categorized as follows:

- UK care home specific = 25
- UK primary care = 5
- UK hospital = 9
- NHS in general = 19
- Other non-UK settings = 6

The majority of UK care home specific publications were related to preventing prescription errors (n=15). Nine of these were studies that attempted to quantify the benefits of interventions aimed at preventing errors. Most of the interventions were medication reviews by either pharmacists or GPs aimed at reducing inappropriate prescribing. The remaining six publications simply described ways in which different health care professionals could help identify inappropriate prescribing. Ten publications with a UK care home focus, described ways in which administration errors could be reduced. There were no specific publications related specifically to dispensing or monitoring errors. However, it is expected that medication reviews also considered the issue of monitoring medication.
Bibliography


Morecambe Bay Primary Care Trust, "Morecambe Bay Primary Care Trust guidelines," 2000.


Royal College of General Practitioners and British Geriatrics Society, "Frailty, Older People and Care Homes. Can we do better?," 2009.


[50] National Collaborating Centre for Primary Care, "Medicines adherence guideline - Involving patients in decisions about prescribed medicines and supporting adherence," 76, Jan. 2009.


[58] J. Glare, S. Coldfield, and A. Mans, "Hospital admissions related to medications: a literature review," UKMi West Midlands; Keele University; Faculty of Health; Department of Medicines Management, Apr. 2010.


Appendix 1:
Search strategies used in electronic databases

Ovid MEDLINE(R) 1996 to February Week 2 2010

<table>
<thead>
<tr>
<th>#</th>
<th>Searches</th>
<th>Results</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>exp Drug Prescriptions/</td>
<td>11467</td>
</tr>
<tr>
<td>2</td>
<td>Hospices/</td>
<td>1399</td>
</tr>
<tr>
<td>3</td>
<td>residential facilities/ or homes for the aged/ or exp nursing homes/</td>
<td>15249</td>
</tr>
<tr>
<td>4</td>
<td>exp Pharmaceutical Preparations/</td>
<td>255777</td>
</tr>
<tr>
<td>5</td>
<td>medical errors/ or medication errors/</td>
<td>13660</td>
</tr>
<tr>
<td>6</td>
<td>1or5</td>
<td>24344</td>
</tr>
<tr>
<td>7</td>
<td>6and3</td>
<td>253</td>
</tr>
<tr>
<td>8</td>
<td>exp Great Britain/</td>
<td>121658</td>
</tr>
<tr>
<td>9</td>
<td>exp geographic locations/</td>
<td>1304021</td>
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<td>10</td>
<td>9not8</td>
<td>1182363</td>
</tr>
<tr>
<td>11</td>
<td>7not10</td>
<td>74</td>
</tr>
<tr>
<td>12</td>
<td>limit 11 to (english language and yr=&quot;2005 -Current&quot;)</td>
<td>29</td>
</tr>
<tr>
<td>13</td>
<td>from 12 keep 1-29</td>
<td>29</td>
</tr>
<tr>
<td>14</td>
<td>Patient Readmission/</td>
<td>3378</td>
</tr>
</tbody>
</table>

Patient readmission brought up 10 results, all new and all irrelevant.

EMBASE 1996 to 2010 Week 07

<table>
<thead>
<tr>
<th>#</th>
<th>Searches</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>nursing home/</td>
<td>8912</td>
</tr>
<tr>
<td>2</td>
<td>residential care/</td>
<td>3007</td>
</tr>
<tr>
<td>3</td>
<td>*medication error/</td>
<td>1430</td>
</tr>
<tr>
<td>4</td>
<td>*prescription/</td>
<td>7093</td>
</tr>
<tr>
<td>5</td>
<td>3or4</td>
<td>8400</td>
</tr>
<tr>
<td>6</td>
<td>1and5</td>
<td>97</td>
</tr>
<tr>
<td>7</td>
<td>exp United Kingdom/</td>
<td>70526</td>
</tr>
<tr>
<td>8</td>
<td>exp geographic names/</td>
<td>712889</td>
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<tr>
<td>9</td>
<td>8 not 7</td>
<td>642363</td>
</tr>
<tr>
<td>10</td>
<td>6 not 9</td>
<td>68</td>
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<tr>
<td>11</td>
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</tr>
<tr>
<td>12</td>
<td>from 11 keep 1-25</td>
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</tbody>
</table>
Using residential care/ instead of nursing home/ brings up only 13 refs. After all the limits this brings up only one extra – and this is irrelevant.

<table>
<thead>
<tr>
<th>#</th>
<th>Searches</th>
<th>Results</th>
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<tbody>
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<td>3556</td>
</tr>
<tr>
<td>13</td>
<td>medication error/ or prescription/</td>
<td>51357</td>
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<tr>
<td>14</td>
<td>12 and 13</td>
<td>185</td>
</tr>
<tr>
<td>15</td>
<td>nursing home/ or residential care/</td>
<td>11353</td>
</tr>
<tr>
<td>16</td>
<td>&quot;hospital readmission&quot;/</td>
<td>3024</td>
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<tr>
<td>17</td>
<td>((&quot;avoidable admission&quot; or readmission) adj3 hospital).ti,ab.</td>
<td>895</td>
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<td>18</td>
<td>&quot;medication therapy management&quot;/</td>
<td>92</td>
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<tr>
<td>19</td>
<td>15 and 18</td>
<td>3</td>
</tr>
<tr>
<td>20</td>
<td>14 or 19</td>
<td>187</td>
</tr>
<tr>
<td>21</td>
<td>20 not 9</td>
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<td>23</td>
<td>22 not 11</td>
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<tr>
<td>24</td>
<td>from 23 keep 1-37</td>
<td>37</td>
</tr>
</tbody>
</table>

Med therapy man/ only brought up 3 refs – which were all included under medication error/ or prescription/. It was used as all 3 were relevant.

Hospital readmiss/ & text search brought up only irrelevant or already-found articles.

Notes
Improving medication management in care homes is a systemwide issue, which needs to be tackled by many different groups working together. This work is now being taken forward in an integrated programme led by the National Care Forum, funded by the Department of Health, working as part of a wider cross-sector partnership. This partnership involves:

- Age UK
- English Community Care Association
- National Care Forum
- Royal College of General Practitioners
- Royal College of Physicians
- Royal Pharmaceutical Society
- Care Provider Alliance
- National Care Association
- Registered Nursing Home Association
- Royal College of Nursing
- Royal College of Psychiatrists
- The Health Foundation