1 **Systematic review to inform the development of a community pharmacy**
2 **based intervention for people affected by dementia**

3

4 **Abstract:**

5 **Background:** People living with dementia (PWD) frequently receive medicines regularly from their

6 community pharmacy, thus providing an opportunity to address either directly or through a carer

7 any unmet medicines-related needs. The aim of this systematic review was to identify and describe

8 dementia-specific pharmacy-based interventions with potential for delivery through community

9 pharmacy. This would inform the design of future services and associated trials.

10 **Methods:** Ovid MEDLINE, EMBASE and CINAHL databases were searched along with, Opengrey, NHS

11 evidence and references from included studies. Search terms included 'dementia' and 'pharmacist'

12 plus their synonyms. Two independent researchers screened titles, abstracts and papers

13 sequentially. A data extraction tool was developed based on PRISMA and EPOC, which included

14 reporting all process, humanistic, clinical and economic outcome measures. The GRADE approach

15 assessed the quality of the reviewed research.

16 **Results:** The systematic review process identified twenty-nine studies. Interventions were

17 categorised as medication review, targeted medicine intervention, education, memory screening

18 and miscellaneous. Five studies were set in community pharmacy. Interventions frequently targeted

19 antipsychotics, benzodiazepines and anticholinergic medication. Twenty interventions were

20 medicine-related. Eighteen studies were categorised as 'very low' quality, often due to small sample

21 size.

22 **Conclusions:** The review identified a range of interventions, which could be delivered through

23 community pharmacy, and potentially benefit PWD. Developing appropriate and efficient training

24 and working in multi-disciplinary teams was identified as necessary for effectiveness. Further

25   research is needed to identify which service elements are likely to be acceptable to both patients

26   and practitioners as well as the barriers and enablers to their implementation.

27

28   **Key words:** systematic review, community pharmacy, medicines management,

29   dementia

30

Background

32 The number of people living with dementia (PWD) worldwide is expected to almost double every 20

33 years and reach 131.5 million in 2050 [1]. In response to these predictions the World Health

34 Organization has recently published a global action plan for 2017 – 2025 recommending the need to

35 develop services which increase dementia awareness, improve dementia care support, provide

36 support for carers and expand dementia related research [2].

37 People living with dementia often have co-morbidities and will be prescribed several medicines in

38 addition to those for dementia [3, 4]. As the dementia progresses, the individual becomes less able and

39 will increasingly need help from a paid or unpaid carer [5, 6]. Carers can often lack medicine

40 administration training, possess minimal knowledge about the medicines or understanding of how to

41 communicate effectively with a person living with dementia. All of these factors could lead to sub-

42 optimal medicines management [7]. The patient and/ or carer may often have a limited support

43 network drawn from their families to their general practitioners, nurses or social workers [8].

44 It is estimated that 89% of the United Kingdom (UK) population live within a 20 minute walk from a

45 community pharmacy [9]. Consequently, in many instances community pharmacists and their staff are

46 ideally located to provide support to address unmet medicine-related needs for PWD either directly

47 or through carers. The increasing use of technology such as dispensing robots [10] and pharmacy

48 technicians reflects the fact that medicines supply has become a technical role. In addition to this,

49 people are living longer and are staying within the community for longer periods of time, which is

50 further increasing the need for accessible, high quality primary care. In response to this, pharmacists

51 in the community setting must increasingly consider how they can utilise their medicines expertise

52 to make a greater contribution to patient care.

53 A significant evidence base built from a variety of countries (such as the UK, USA, Taiwan and

54 Thailand) already exists for the management of a number of common chronic conditions such as

55   hypertension [11, 12], diabetes [13, 14] and services such as warfarin monitoring [15] through community

56   pharmacy. The recent UK government review of evidence for clinical pharmacy services provided

57   through community pharmacy recommended greater involvement in the management of long term

58   conditions and that this could be delivered through a redesigned nationally funded adherence

59   intervention (Medicines Use Review) [16].

60   Similarly to hypertension and diabetes, dementia is another chronic disease, which may be

61   potentially suitable for inclusion in such a service. However, the exact nature of the service and how

62   best to deliver it is currently unknown.

63   Systematic reviews focussed on healthcare interventions targeted at PWD which involve any

64   healthcare professionals is sparse, particularly within a primary care setting.

65   This systematic review therefore aims to identify and evaluate the current research of interventions

66   aimed towards patients affected by dementia that utilise a member of the pharmacy team. This will

67   be achieved by: (i) describing the study characteristics; (ii) describing the extent and nature of the

68   interventions; (iii) identifying the effective and ineffective elements of the interventions and; (iv)

69   assessing the quality of the studies.

70

71   **Methods**

72   **Protocol registration**

73   The protocol for this systematic review was registered with PROSPERO on 12th July 2016:

74   CRD42016042787 and the review was conducted between July and November 2016,

75   **Search Strategy and selection criteria**

76   *Search Strategy*

77 Search terms (defined in Supplementary data, appendix 1,) following the PICO (Population,

78 Intervention, Comparator, Outcomes) method [17] aimed to retrieve studies where interventions

79 utilising a pharmacy team member had occurred targeted at people affected by dementia. A

80 previous scoping review by the author had revealed a dearth of studies in this field and therefore a

81 broad research question with flexibility of the usual systematic review processes was required in

82 order to extract the most information possible. This included the identification of any reported

83 outcome measures (and the consequent inability to use PICOS search terms for 'comparator' and

84 'outcomes'), any types of study from any country, in any language and using no date restrictions.

85 The sources searched in July 2016 were:

86 • Ovid MEDLINE® In-Process & Other Non-Indexed Citations and Ovid MEDLINE® 1946 to

87   present, OvidSP

88 • EMBASE, 1974 to present, OvidSP

89 • CINAHL Complete, EBSCOhost

90 • Grey literature at www.opengrey.eu

91 • NHS Evidence with the search restricted to 'Primary research', 'Drug/medicine

92   management' and 'Policy and service development' for types of information and 'Public

93   health', 'social care', 'clinical' and 'drugs and technologies' for area of interest.

94 • Bibliographies of included studies

95 Retrieved studies were initially screened for their suitability by two independent researchers using

96 just their titles. Successful titles then had their abstracts screened against the inclusion criteria by

97 two independent researchers. Full articles were then retrieved and assessed for their inclusion by

98 two independent researchers. Discrepancies were resolved through discussion between the

99 researchers and a Cohens Kappa Coefficient was calculated at each stage as a measure of inter-rater

100 agreement.

101 *Inclusion Criteria*

102   Selected studies were assessed against the following inclusion criteria: (i) minimum of 70%

103   prevalence of dementia within the target population. Following the scoping review by the author,

104   the prevalence was reduced to 70% so that a higher number of studies could be included which may

105   provide helpful insights into potential interventions that could be of use in PWD within a community

106   pharmacy setting ; (ii) a pharmacy team member had a key role in delivering the intervention

107   meaning that the intervention would not have been able to be conducted without the input of the

108   pharmacy team member; (iii) empirical data available (i.e. not the published protocol) and; (iv) the

109   presence of an intervention.

110   *Exclusion Criteria*

111   Studies were excluded if there was no intervention present, no member of a pharmacy team present

112   for any aspect of the intervention, or the target population for the intervention was not mostly

113   dementia. Studies could be excluded for more than one reason.

114

115   **Data extraction**

116   An extraction tool was specially designed for this review and was based on the Preferred Reporting

117   Items for Systematic Reviews and Meta-Analyses (PRISMA)[18] and the Cochrane Effective Practice and

118   Organisation of Care (EPOC) Review Group Data Collection Checklist [19]. Data recorded included:

119   study characteristics; nature and extent of intervention; outcome data measures and results;

120   effective and ineffective elements of interventions. The effective and ineffective elements were

121   obtained from the authors' own reflections within the paper and then categorised.

122   Once data extraction was completed, a sample of the extracted data was checked for accuracy by a

123   second reviewer.

124   **Meta-analyses**

125 Due to the broad nature of this review, meta-analyses, which would usually be applied to systematic

126 reviews and is featured within PRISMA, was not feasible.

127 **Quality assessment**

128 The overall quality of the studies was assessed using an adapted version of the GRADE Working

129 Group (Grades of Recommendation, Assessment, Development and Evaluation Working Group) as

130 suggested by Cochrane[17]. GRADE places an initial quality rating on each study based on their study

131 design (randomised controlled trials (RCTs) are given a rating of HIGH and non-RCTs are rated LOW).

132 Quality ratings can then be upgraded or downgraded to 'VERY HIGH', 'HIGH', 'MODERATE' 'LOW' or

133 'VERY LOW' based on 8 criteria. The previous scoping review had suggested most current studies

134 were likely to be small service evaluations. This meant that the GRADE upgrade criteria (large

135 magnitude of effect, dose response and the effect of all plausible confounding factors would be to

136 reduce the effect) were not likely to be relevant in most cases. It was therefore decided to use the

137 downgrading factors listed below as the criteria for both upgrades and downgrades of studies[20]:

138   • Reporting bias (such as unreported results for stated outcome measures),

139   • Inconsistency (such as inconsistency of results or unexplained heterogeneity),

140   • Indirectness (such as the inclusion of people outside of interest or small number of

141   comparators),

142   • Imprecision (such as small sample size or wide confidence intervals),

143   • Limitations in design (such as a high number of limitations or high likelihood of bias in the

144   study design).

145

146 # Results

147 Twenty-nine studies were selected for data extraction and the PRISMA flowchart for data selection is

148 presented in Figure 1.

Study Characteristics

Table 1 presents the study characteristics of the 29 included studies. Only one study was a

randomised controlled trial, whereas 21 were service evaluations. Seven studies were only available

as conference abstracts and 1 article was written in French (which was translated using online

translation software). Settings included clinics, nursing homes, and hospitals, with 5 studies set in

community pharmacies. The majority of studies were conducted after 2010 and were mostly

conducted in the USA or the UK.

Extent and nature of Interventions

The identified interventions were grouped into five categories as follows: medication review,

targeted medicine intervention, education, memory screening, or miscellaneous.

Scope of interventions

Twenty interventions (69%) were medication related (Table 2) with the use of antipsychotics (n=10),

anticholinergics (n=6) and/or benzodiazepines (n=6) in people affected by dementia being a key

theme. Education interventions included a Donepezil outpatient service providing advice and

support to patients newly prescribed Donepezil [21] and the training of Primary Care Navigators who

can provide advice, support and signposting services in primary care to people affected by dementia

[22]. Memory screenings conducted by pharmacists utilised well-known screening techniques such as

the Mini-cog [23, 24]; Mini-Mental Screening examination (MMSE) and the Clock-Drawing test [25]. The

studies in the miscellaneous category included an audit identifying an array of interventions within

community pharmacy [26] and the assessment of patient's cognitive function and ability to fill and use

a pillbox [27]. Table 3 provides further information regarding the interventions identified.

173 **Multidisciplinary involvement**

174 Only 5 (17%) of the studies were conducted solely by a pharmacist with no input from other

175 healthcare professionals. Table 2 also summarises the input of other healthcare professionals

176 (HCPs), which were required in additional to pharmacists, for the successful implementation of the

177 interventions. The most common professional to be included were doctors who held a variety of

178 roles from general practitioners that followed up with patients after a referral from a community

179 pharmacist [24] to a geriatrician, who was part of weekly multidisciplinary medication reviews in care

180 home residents [28].

181

182 **Reported outcomes**

183 A wide variety of outcome measures were identified within this review with most being 'humanistic'

184 or 'process' related in nature and fewer being 'clinical'. Table 4 shows examples of some of these

185 outcomes reported with examples from the studies. Although only 1 study specified an economic

186 related outcome measure 'patient's willingness to pay for memory screening service', 3 studies in

187 total reported economic based results.

188 **Effective and Ineffective elements**

189 **Effective elements**

190 A range of elements were reported as being effective, the most common being related to the use of

191 a pharmacist in the intervention and the use of multidisciplinary teams. Watanabe et al [21] states how

192 the value of involving pharmacists in dementia care and their outpatient model could also apply to

193 local dispensing pharmacies for providing support to patient's families. Collier et al [28] noted how

194 regular multidisciplinary medicine review meetings had a positive impact on prescribing

195 psychotropics and reducing the number of elderly residents' medications . Other elements found

196 effective included minimal training [23, 25], mixed methods training [22], low cost of intervention [29], the

197   intervention being quick to conduct [23, 25], accessibility of intervention [22, 23] and the ability for the

198   intervention to be replicated [24].

199   **Ineffective elements**

200   Fourteen elements were recorded by authors, as ineffective (with 5 derived from one article [22]).

201   Ineffective elements included: reliance on a dementia register for identifying patients with dementia

202   using antipsychotics [30], poor level of follow-ups from doctors following pharmacist

203   recommendations and communication difficulties between HCPs [24], service-user involvement being

204   dependant on self-reporting and poor tool sensitivity [25], difficulties raising awareness of the

205   intervention, having the time to conduct the intervention and convincing doctors of potential

206   benefits of the intervention [22].

207

208   **Quality**

209   One study received a quality rating of 'high' due to its' randomised control design whereas 26

210   studies were rated 'low' or lower (see Table 5) quality study designs which largely consisted of

211   service evaluations. Fourteen studies were downgraded for imprecision which was largely due to the

212   small sample sizes reported and only 5 studies were upgraded.

213

214   # Discussion

215   This review provides evidence that pharmacy teams have provided services in a range of settings but

216   few which incorporate community pharmacies. In addition to this, a large proportion of the studies

217   included in this review were service evaluations, which leads to there being insufficient high-quality

218   evidence to supporting the development of future community pharmacy interventions.

219 The most common countries to have conducted the research were the UK and the USA and the most

220 common forms of intervention involved a medicines review or the provision of support to either a

221 PWD or their carer. A large number of the interventions targeted specific medicine groups such as

222 antipsychotics, benzodiazepines and anticholinergics and the majority of interventions involved

223 working with other HCPs. Doctors and nurses were predominantly involved but some studies utilised

224 the expertise of other HCPs such as social workers, physiotherapists and other allied HCPs. These

225 multidisciplinary teams were reported by some authors as contributing effectively to their studies

226 along with training methods, accessibility, and the ability for the model to be replicated in other

227 settings.

228 Few ineffective elements were reported and no common themes were found but key elements to

229 consider included difficulties identifying potential service users and the lack of time to perform the

230 new role.

231 A large strength to this review was that the author initially conducted a scoping review, which

232 enabled the inclusion criteria to be broadened and the search terms to be refined which ensured

233 that all relevant studies were included.

234 Several of the included studies were only presented as conference abstracts and so limited

235 information for data extraction was available which was a limitation to this review. A further

236 limitation was that detailed information regarding the education of staff members was not recorded

237 or critiqued, which in hindsight would have been a valuable element to evaluate.

238 The Kappa scores calculated at each stage of this review ranged from 'fair' to 'moderate' [31] which

239 shows that some disagreement was present between the reviewers. However, the discussions,

240 which followed ensured that the disagreements were resolved, and that no reviewer bias could

241 impact the final list of included studies or jeopardise the quality of the results.

242 The small number of community pharmacy-based interventions found in this review may follow

243 from the difficulties with including PWD in research. Identifying, recruiting and gaining informed

244 consent can be barriers that researchers may find difficult when designing large scale studies with

245 this group [32]. Studies have previously reported that community pharmacy staff are motivated to take

246 part in research so as to help improve the profession and use as an opportunity to learn [33]. However,

247 a lack of time (for either recruiting patients into a study or for conducting the intervention itself),

248 staff, money, knowledge, skills and difficulties communicating between both the study teams and

249 the pharmacy staff members have been described as common barriers for community pharmacy

250 staff to take part in research studies [33-35]. These factors need to be carefully considered in the

251 development of an intervention to ensure successful involvement of community pharmacies in large

252 scale trials. Additionally, focussing on these factors will assist the intervention to be implemented

253 into community pharmacies effectively and ensure that the service reaches its maximum potential

254 for level of activity and patient benefit.

255 The UK and the United States have a history of being within the top 10 of having the largest

256 pharmaceutical market value in the world, with the latter repeatedly being at number 1 [36]. This may

257 provide some reasoning for why these countries feature so heavily within this review's results. The

258 inclusion of other countries such as Sweden, Slovenia and Norway shows how research is slowly

259 building momentum worldwide which is being further driven by such events such as the World

260 Health Organisation (WHO) recognising dementia as a public health priority in 2012 [8] and the World

261 Health Assembly adopting the Global Action Plan on Dementia in 2017 [2].

262 Pharmacies already provide certain medication review services, which are readily available in

263 community pharmacies in the UK and are not targeted towards particular patients. The medication

264 reviews reported within this review concentrated on certain medicines, which are more specific to

265 PWD. Antipsychotics are commonly prescribed in dementia to help relieve Behavioural and

266 Psychological Symptoms of Dementia (BPSD) but can increase the risk of cerebrovascular adverse

267 events or death and should therefore be prescribed only where necessary and should be reviewed

268 regularly [37, 38]. Benzodiazepines are commonly prescribed in the elderly [39] yet 1 in 7 will have an

269 adverse event such as dizziness or confusion [40]. Anticholinergics further reduce the amount of

270 cholinesterase in the body and therefore counteract the effects of the acetylcholinesterase

271 inhibitors used to manage dementia and a patient's confusion can be enhanced increasing the risk of

272 falls, fractures and hospitalisation [41]. These medicines are often prescribed inappropriately [4, 42] in

273 PWD and therefore an obvious role for community pharmacists could be to incorporate a criteria

274 such as the anticholinergic burden scale or the drug burden index [43] into their medication reviews. In

275 order to undertake this however, the pharmacist will need to receive appropriate training and have

276 access to up to date national and local guidelines regarding the use of such medicines.

277 With the wide range of interventions identified, it is understandable that there was also a wide

278 range of outcome measures reported amongst the studies. Although the results tended to be in

279 favour of the interventions, the lack of economical data provides a barrier for potential long-term or

280 nationwide implementation. Future studies evaluating the use of community interventions should

281 endeavour to include an economical element in order to assess whether the intervention is not only

282 effective but also cost-effective.

283 The elements reported as effective by authors provides guidance on what components are

284 important in the development of a future intervention. A community pharmacy intervention for

285 people affected by dementia should ideally have an effective staff training model which builds on

286 existing skills, be low-cost, relatively quick to implement. It should also provide evidence-based

287 benefit to the patient and / or family, be easily replicated in other settings and be accessible to all

288 service-users.

289 Another effective element reported was the incorporation of other HCPs. The need for pharmacists

290 in all settings to work in less isolation for the successful implementation of future interventions is

291 clearly highlighted in this review by the high number of studies that utilised other HCP's.

292   Multidisciplinary teams can lead to positive changes in health care such as improvements in patient

293   care and reduced hospital stays [44] and this review shows how PWD may interact with a large range

294   of professionals throughout their dementia journey ranging from doctors, nurses and pharmacists to

295   music therapists, occupational therapists and social workers.

296   Community pharmacists currently work in professional isolation on a regular basis and this may

297   represent a significant barrier to intervention development. When designing a future intervention,

298   relevant healthcare and non-healthcare professionals should be involved in the design and

299   encouraged to identify how their involvement could improve patient care. Early and continuous

300   involvement of other HCPs may improve the success of the intervention and would be in line with

301   the recommendations made within the Murray Review [16] for further community pharmacy

302   integration.

303   High quality study designs (such as randomised controlled trials) have previously been used to test

304   the effectiveness of community pharmacy based services for other chronic conditions such as

305   diabetes [13] and hypertension [11], yet this review highlighted how there have been only a small

306   number (and of low quality), studies in the field of dementia. This may reflect the relatively recent

307   shift in focus to increase public awareness of dementia and improve dementia care.

308   Action area 7 of the WHOs Global Action Plan is 'dementia research and innovation' which aims to

309   double the global research on dementia between 2017 and 2025 [45]. This review supports comments

310   within the Global Action Plan regarding the current dearth of high quality research being undertaken

311   in this area and emphasises the need for larger, higher quality study designs to be conducted such as

312   randomised controlled trials. Higher quality studies in this area will generate higher quality evidence

313   and will enable developed interventions for people affected by dementia to be implemented more

314   effectively. An increase in high quality studies will also have implications for policy makers who will

315   be more driven to develop evidence-based guidance and policies within this area, which will further

316   benefit people affected by dementia.

317

Conclusion

319 This review highlights a large range of interventions targeted at people affected by dementia, which

320 incorporate a member of the pharmacy team and offering potential for a larger role for community

321 pharmacy in the care of people affected by dementia. For the role to continue to evolve and to

322 provide enhanced support to patients, community pharmacists will need appropriate training and to

323 be further integrated into primary care teams. Before such services can be developed and tested it

324 will still be necessary to identify which elements identified within this review are believed to be and

325 evidenced to be acceptable, feasible and effective if delivered through a community pharmacy. It is

326 also important to identify the barriers and enablers to their implementation and suitable approaches

327 to service design, which either utilise or address them. Better quality studies testing the

328 effectiveness of new services are then needed in order to provide more influential evidence for

329 service commissioners.

Ethical Approval

331 Ethical approval was not required for this systematic review.

Funding

335

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505   *Table 1*. Study Characteristics

Author	Year	Service evaluation	Case study	Cross-sectional	Other	Country	Setting	Sample size	Conference Abstract
Collier [28]	2013	✓				Ireland	Care/nursing home	54	✓
Conlon [46]	2009-10	✓				Ireland	Care/nursing home	67	✓
Furniss [29]	2000				✓[a]	UK	Care/nursing home	330	
Hursh [47]	2008-09	✓				USA	Care/nursing home	~130	
Kröger [48]	2014	✓				Canada	Care/nursing home	48	
Maidment [49]	2011	✓				UK	Care/nursing home	26	✓
Monette [50]	2004	✓				Canada	Care/nursing home	90	
Anderson [27]	2014			✓		USA	Clinic	150	
Nakamura [51]	2012-14	✓				Japan	Clinic	35	
Patel [52]	2010	✓				USA	Clinic	20	✓
Sakakibara [53]	2014				✓[b]	Japan	Clinic	50	
Sonnett [23]	2012			✓		USA	Clinic	302	
Setter [54]	2004-5			✓		USA	Community dwelling	100	
Anonymous [22]	2014-15	✓				UK	Community Pharmacy	?	
Breslow [25]	2013	✓				USA	Community Pharmacy	26	
Fountain [55]	2007		✓			USA	Community Pharmacy	1	
Manrai [26]	2015				✓[c]	UK	Community Pharmacy	?	✓
Rickles [24]	2008	✓				USA	Community Pharmacy	161	
Gustafsson [56]	2012	✓				Sweden	Geriatric care unit	895	
Child [30]	2011	✓				UK	GP Surgery	70	
Stuhec [57]	2013	✓				Slovenia	GP Surgery	629	✓
Efjestad [58]	2011	✓				Norway	Hospital (all)	50	
Farrell [59]	2013		✓			Canada	Hospital Inpatient	1	
Frausto [60]	2013-14	✓				USA	Hospital Inpatient	128	
Mouchoux [61]	2011	✓				France	Hospital Inpatient	97	
Paquin [62]	2010-12	✓				USA	Hospital Outpatient	501	
Watanabe [21]	2008-12	✓				Japan	Hospital Outpatient	111	
D'Souza [63]	2010-12	✓				USA	Medical centre	162	
Cations [64]	2015	✓				Australia	Residential aged care facility	81	✓

[a] Randomised controlled trial; [b] Non-randomised intervention study; [c] Audit

506   *Table 2. Other healthcare professionals involved in addition to pharmacists*

Author	Medicines targeted (Ap, Ch, Be) [a]	Healthcare Professional						
		Doctor	Nurse	Social Worker	Pharmacy team member	Nurse's aide	General practice team member	Other
Medication Review								
Collier [28]	Ap	✓	✓					
Conlon [46]	Ap	✓	✓					
D'Souza [63]	Ch	✓	✓	✓				
Farrell [59]								
Fountain [55]		✓		✓		✓		
Frausto [60]		✓	✓					✓ [b]
Furniss [29]	Ap, Be							
Gustafsson [56]	Ap, Ch, Be	✓	✓					
Kröger [48]		✓	✓					
Mouchoux [61]	Ap, Ch, Be	✓	✓	✓				✓ [c]
Paquin [62]	Ap, Ch, Be							
Patel [52]	Ch							
Stuhec [57]		✓						
Targeted Medicine Intervention								
Cations [64]	Ap	✓						✓ [d]
Child [30]	Ap	✓						
Efjestad [58]	Ch	✓						
Hursh [47]	Ap		✓	✓				
Maidment [49]	Ap, Be	✓						
Nakamura [51]	Donepezil	✓						
Sakakibara [53]	Be	✓						
Education								
Anonymous [22]					✓ [e]		✓	
Monette [50]								
Watanabe [21]		✓	✓					
Memory Screening								
Breslow [25]		✓						
Rickles [24]		✓						
Setter [54]			✓					
Sonnett [23]								
Miscellaneous								
Anderson [27]								✓ [f]
Manrai [26]					✓ [g]			

[a] Ap = Antipsychotic, Ch = Anticholinergic, Be = Benzodiazepine); [b] Other members of inpatient medical team; [c] Physiotherapist, occupational therapist, music therapist, speech therapist; [d] Care home staff; [e] Community pharmacy healthcare assistants and pharmacy dispensers [f] Research assistant with psychology training; [g] Community pharmacy technician

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509   *Table 3*. Descriptions of included interventions

Study	Intervention	Study time period
Anderson [27]	Three visits to patient where cognitive function and ability to fill and use a pillbox were examined.	Unknown
Anonymous [22]	Primary Care navigators (PCNs) trained by variety of methods including training days, e-learning and ongoing mentoring. PCN role then piloted which included interventions such as non-clinical 'bridging; role connecting and signposting those with dementia and carers to services, support and information.	June 2014 – Feb 2015
Breslow [25]	Following 8 hours of home study, a 6-hour live program and a 4-hour refresher course, memory screening was conducted 2 pharmacists using MMSE, category (animal) fluency test and clock-drawing test. Results sent to GP. Satisfaction survey completed. Pharmacies received $75 remuneration for each participant screened.	Unknown
Cations [64]	Pharmacist and GP proposed antipsychotic dose reductions when used for BPSD.	12 months
Child [30]	People on a dementia register, receiving low-dose antipsychotics identified and included in a pharmacist-led medication review aimed at reducing antipsychotic use.	Jan-Dec 2011
Collier [28]	Regular multidisciplinary medication review meetings on the prescribing of psychotropic medications (follow-up study to Conlon et al.)	Sept 2013
Conlon [46]	Regular multidisciplinary medication review meetings on the prescribing of psychotropic medications.	March 2009 – March 2010
D'Souza [63]	Telephone and home visits by social worker and nurse, pharmacist conducts medication review and reviews with nurse. Support from interdisciplinary team which meets weekly to formulate plans and interventions.	2 years
Efjestad [58]	Anticholinergic drug scale (ADS) score created for each patient and suggestions provided to geriatricians for changes to medicines.	June – Dec 2011
Farrell [59]	45-minute patient interview, review of charts and medicines communication with family and community pharmacy with aim of reducing pill burden and improving adherence.	12 weeks
Fountain [55]	Medication review and home visit (involving MMSE examination) to patient. Several changes made with help of interdisciplinary team.	Days
Frausto [60]	Inpatient face to face meeting for medicine reconciliation and recommendations to inpatient team. Once discharged, another medicine reconciliation by phone with recommendations made to primary care provider.	May 2013 – Oct 2014
Furniss [29]	Pharmacist assessed whether use of neuroleptics complied with US OBRA [a] guidelines and recommended changes to GP.	8 months
Gustafsson [56]	Medication review to assess for specific potentially inappropriate drugs. Suggestions then discussed with health care team during rounds with GP making final decision.	Approximately 12 months
Hursh [47]	Interdisciplinary team aimed at reducing antipsychotic use by: Staff education, using non-pharmacological measures and improving documentation tools to track behaviour interventions and pain management.	May – Aug 2008
Kröger [48]	Following 180 mins of education sessions, pharmacist performed medication reviews using a tailored list created to aid medicine optimisation. Recommendations discussed with nurses and physicians.	April – Nov 2014
Maidment [49]	All medication (with an emphasis on psychotropics) of residents with dementia within a nursing home reviewed based on National Prescribing Centre level 3 medication review criteria and US OBRA (Ombudsman reconciliations) guidelines. Problems defined, ranked and alternative solutions developed.	Approximately 6-12 months
Manrai [26]	Interventions identified included: dose alterations, delivery date information to patients, medication reconciliation and medication counselling.	6 weeks
Monette [50]	Following an interdisciplinary educational program (which included overviews on non-pharmacological approaches for disruptive behaviours and the need to administer the lowest effective dose), pharmacists identified patients on a monthly basis taking antipsychotics at the same dosage for more than 3 months and requested the physician to assess if the drug could be reduced or discontinued.	Feb - Aug 2004
Mouchoux [61]	Analysis of medicines on admission to the unit and multidisciplinary reviews. Pharmaceutical interventions recorded.	12 months
Nakamura [51]	Pharmacist recommended Donepezil dose increase from 5mg/day to 10mg/day to physician if patient assessed to be at AD stage 5 or 6 with use of a checklist, questionnaire and swallowing test.	4 months

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511 **Table 3 (continued).** *Descriptions of included interventions*

Study	Intervention	Study time period
Paquin [62]	Comprehensive review of medications, a medication safety check via use of a checklist and a telephone call with patients and caregivers 2-5 days post discharge.	2010 – 2012
Patel [52]	Interprofessional clinic for patients with cognitive impairment that included a clinical pharmacist who assessed their medication charts for pharmacotherapeutic problems.	July – Sept 2010
Rickles [24]	Memory screening assessment (mini-cog and animal fluency test) by trained pharmacist followed by customized counselling and referral to GP if needed.	June – Nov 2008
Sakakibara [53]	A pharmacist proposed the reduction of prescribed benzodiazepines.	March – July 2014
Setter [54]	Rapid 3-minute mini-cog (which included a three-item recall task and a clock-drawing task) to homebound patients to screen for undiagnosed cognitive impairment.	Sept 2004 – June 2005
Sonnett [23]	Patients were administered the mini-cog and primary care providers contacted if results required action.	June 2006 – March 2007
Stuhec [57]	Review of patients' records and any inadequate doses of AD medications reported to GP.	12 months
Watanabe [21]	Donepezil Outpatient Consultation Service provided the patient and carer's with detailed information about Donepezil and AD.	April 2008 – March 2012

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514   *Table 4. Examples of ECHO outcome measures and results reported*

ECHO category	Study	Outcome measure	Result reported
Economical	Rickles [24]	Willingness to pay	56.4% were 'willing to pay' for the service
Clinical	Nakamura [51]	Dementia severity	20/27 patients showed at least one stage improvement in severity
	Efjestad [58]	Anticholinergic drug scale scores (ADS)	Where ADS was ≥, median score reduced from 2.5 to 1 (p=0.009) post intervention
Humanistic	Furniss [29]	Number of falls and deaths	Fewer deaths (4 vs 14) in intervention homes (p=0.028)
	Fountain [55]	Risk of falls	Risk of fall reduced
	Nakamura [51]	Caregiver burden (J-ZBI_8[*] score)	Mean J-ZBI_8[*] score for personal strain reduced from week 0 to week 4 (p<0.05) through to week 16 (p<0.01).
	Rickles [24]	Patient satisfaction	98.6% were 'very satisfied'/'satisfied' with program
Process	Conlon [46]	Number of prescribed medicines per patient	Reduction in average number of medicines per patient from 7.1 to 6 (p<0.003)
	Mouchoux [61]	Number of interventions	190 interventions proposed by pharmacist with 77.9% accepted
	Monette [50]	Proportion of discontinued psychotropics	40 (49.4%) psychotropics discontinued
	Rickles [24]	Proportion of patients referred	54 (33.5%) of screened patients referred

[*] *Japanese version of the Zarit Caregiver Burden Interview*

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516 **Table 5.** *Quality assessment grades of included studies.*

Author	Category	Limitations	Inconsistency	Indirectness	Imprecision	Reporting Bias	Overall Quality of paper
Collier [28]		0	0	0	-	-	VERY LOW*
Conlon [46]		0	0	0	0	-	VERY LOW
D'Souza [63]		0	0	-	0	0	LOW
Farrell [59]		0	0	0	-	0	VERY LOW*
Fountain [55]		0	0	0	-	-	VERY LOW*
Frausto [60]		0	0	-	0	0	VERY LOW*
Furniss [29]	Medication Review	0	0	0	0	0	HIGH
Gustafsson [56]		0	0	0	+	0	MODERATE
Kröger [48]		0	0	-	-	-	VERY LOW*
Mouchoux [61]		0	0	0	0	0	LOW
Paquin [62]		-	0	0	0	0	VERY LOW
Patel [52]		0	0	0	-	-	VERY LOW
Stuhec [57]		0	0	0	0	-	LOW
Cations [64]		-	-	0	-	0	VERY LOW*
Child [30]		-	+	0	0	0	LOW
Efjestad [58]	Targeted Medicine Intervention	0	0	0	-	0	VERY LOW
Hursh [47]		-	0	0	-	0	VERY LOW*
Maidment [49]		0	0	0	-	-	VERY LOW*
Nakamura [51]		0	0	-	0	0	VERY LOW
Sakakibara [53]		-	0	0	-	0	VERY LOW
Anonymous [22]		0	0	0	-	+	LOW
Monette [50]	Education	0	0	0	+	0	MODERATE
Watanabe [21]		0	0	0	-	+	LOW
Breslow [25]		-	0	0	-	0	VERY LOW*
Rickles [24]	Memory Screening	-	0	0	0	0	VERY LOW
Setter [54]		0	0	0	-	0	VERY LOW
Sonnett [23]		0	0	0	0	0	LOW
Anderson [27]	Miscellaneous	0	0	-	0	0	VERY LOW
Manrai [26]		0	0	0	0	0	LOW

Key: Initial score downgraded= - ; Initial score stays the same= 0; Initial score upgraded= +
*Final score technically lower than given score as 'VERY LOW' is the lowest score GRADE uses

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