25. Fried LP, Xue QL, Cappola AR *et al*. Nonlinear multisystem physiological dysregulation associated with frailty in older women: implications for etiology and treatment. J Gerontol A Biol Sci Med Sci 2009; 64: 1049–57.
26. Fried LP, Tangen CM, Walston J *et al*. Frailty in older adults: evidence for a phenotype. J Gerontol A Biol Sci Med Sci 2001; 56: M146–56.
27. Schoufour JD, Mitnitski A, Rockwood K, Evenhuis HM, Echteld MA. Predicting 3-Year survival in older people with intellectual disabilities using a frailty index. J Am Geriatr Soc 2015; 63: 531–6.
28. Schoufour JD, Mitnitski A, Rockwood K, Hilgenkamp TI, Evenhuis HM, Echteld MA. Predicting disabilities in daily functioning in older people with intellectual disabilities using a frailty index. Res Dev Disabil 2014; 35: 2267–77.

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Observational cohort study: deprivation and access to anti-dementia drugs in the UK

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Abstract

Background: UK National Dementia Strategies prioritise fair access to dementia treatments for the whole population. We investigated for the first time inequalities in NHS national dementia prescribing and how they have varied between UK countries and over time.
Method: we investigated the association between Townsend deprivation score and anti-dementia drug prescribing in 77,045 dementia patients from UK primary care records from 2002 to 2013.
Results: we included 77,045 patients with recorded dementia diagnosis or anti-dementia drug prescription. Least deprived patients were 25% more likely to be initiated on anti-dementia drugs than the most deprived (adjusted incidence rate ratio 1.25, 95% confidence interval 1.19–1.31). This was driven by data from English practices where prescribing rates were consistently lower in more deprived patients compared with Scotland, Northern Ireland and Wales, where prescribing was not related to deprivation quintile. Compared with English practices, anti-dementia medication was prescribed more often in Northern Irish (1.81, 1.41–2.34) and less in Welsh practices (0.68, 0.55–0.82), with a trend towards more prescribing in Scottish practices (1.14, 0.98–1.32). Drug initiation rates were also higher in younger people and men.
Conclusion: four years after the English National Dementia Strategy, there is no evidence that the Strategy's key objective of reducing treatment inequalities is being achieved. Higher overall anti-dementia drug prescribing in Scottish and Northern Irish practices, and differing clinical guidelines in Scotland from other UK countries might explain greater equality in prescribing in these countries. Strategies to offer treatment to more deprived people with dementia in England are needed.

Keywords: *dementia, healthcare disparities, cholinesterase inhibitor, older people*

Introduction

Around 6.5% of the UK population aged 65 and over have dementia [1, 2]. Cholinesterase inhibitors and memantine beneficially affect cognitive, functional and global outcomes in Alzheimer's disease and are the only drugs NICE (National Institute for Health and Clinical Excellence) recommend for dementia.

NICE recommended cholinesterase inhibitors for mild and moderate Alzheimer's disease in 2001; restricted this to moderate dementia in 2006 on cost benefit grounds, then reversed these restrictions in 2009; since 2011, they have also recommended memantine. NICE technology appraisals apply in England, Wales and Northern Ireland. NHS Scotland [3] allows Scottish clinicians to follow NICE or Scottish Intercollegiate Guidelines Network (SIGN) guidelines; the less restrictive SIGN guidelines, recommending cholinesterase inhibitors for any severity dementia since 2006 are probably more influential [4]. National Dementia Strategies for England (2009), Scotland (2010) and Wales (2009) promote fair access to treatment. UK anti-dementia drug prescriptions [5] and specialist referrals for dementia have increased in the last decade, alongside memory services investment driven by the Dementia strategies [6] and inclusion of Dementia in the UK Quality and Outcomes Framework (QOF) pay-for-performance system; the proportion of dementia undiagnosed, while still substantial, has decreased in recent years [7].

Inequalities in healthcare access reduce the effectiveness of health policies. People from minority ethnic groups are diagnosed with dementia later in the illness, and those from Black ethnic groups are 30% less likely to receiving cholinesterase inhibitors [8]. Socioeconomic inequalities are less well studied. In Australia (2003–10), cholinesterase inhibitors were prescribed more to less deprived people [9]. In small, probably unrepresentative UK studies, people with dementia who were younger, more deprived [10], from a lower social class or less educated were least likely to receive anti-dementia drugs [11].

In the current study, we investigated for the first time inequalities in NHS national dementia prescribing and how they have varied over the past decade, which has seen an abundance of dementia policymaking. Our objectives were to test our hypothesis that people in the most deprived quintile were less likely than the least deprived to be prescribed anti-dementia drugs between 2002 and 2013. We also hypothesised a priori that: (i) National Dementia Strategies and reversal of previous restrictions in prescribing for mild dementia reduced deprivation inequalities in initiation of prescribing after 2010, by reducing a tendency towards less prescribing in more deprived areas, where primary care is relatively under-resourced [12] and patients may be less knowledgeable and assertive in seeking out treatment [13]; (ii) less restrictive recommendations in Scotland compared with other UK countries between 2006 and 2009 resulted in less inequality by deprivation in Scotland.

Methods

Data source

Approximately 98% of the UK population are registered with a GP [14] and over 90% of NHS contacts are in general practice [15]. The Health Improvement Network (THIN) is a primary care database of 12 million patients (http://www.csdmruk.imshealth.com). Anonymised patients' data are collected from over 500 participating practices that are broadly representative of UK practices in terms of patients' age and sex, practice size and geographical distribution [16]. Broadly reflecting the distribution of UK practices [13], most THIN practices are in England (73%), with 15% in Scotland, 8% in Wales and 4% in Northern Ireland. GPs record medical diagnoses and symptoms using the Read classification system [17]. Prescription information is entered automatically. Information recorded for each registered person includes year of birth, sex, diagnoses and symptom records, prescriptions and quintiles of deprivation score.

Study population

We included patients aged 50 or over with a dementia Read code or at least one anti-dementia drug prescription. We included patients with an anti-dementia drug prescription even if no dementia diagnosis was recorded, as they are only prescribed for dementia. for each practice, we only used data from the date when death recording was considered complete, and computer usage levels acceptable [18, 19]. The cohort was restricted to patients for whom deprivation score quintile was available (98%). This was a dynamic cohort, with patients entering and leaving at difference times. Patients were included from the latest of registration date, age 50 years, or 1st January 2002. Patients were followed from their earliest record of dementia or anti-dementia drug prescription, and follow-up was censored at the earliest date of death, leaving the practice, or 31st December 2013.

Measurements

We included people with Read codes for non-specific dementia, Alzheimer's disease, vascular dementia and all other dementias. The GPs do not always record the subtype diagnosed by a specialist. We examined deprivation by using quintiles of the Townsend score [20], which is linked to a patient's UK postcode and is based on levels of unemployment, car ownership, home ownership and household overcrowding recorded in the 2001 census. In a sensitivity analysis, we used an alternative measure of deprivation: quintiles of the 2007 Index of Multiple Deprivation (IMD) [21] for England. The IMD is based on levels of income, employment, health, education, crime, access to services and living environment. It is only internally valid within countries, and so this sensitivity analysis was restricted to English practices. We defined initiation of anti-dementia therapy as receiving at least one prescription and continuation as receiving 60 consecutive days of doses [22].

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Analysis

Using Stata version 13.1, we calculated incidence rate ratios of anti-dementia drug initiation in a univariable analysis stratified by age, gender, country, deprivation score and time period. We used a Poisson multivariable regression to measure associations between deprivation and anti-dementia drug prescribing after accounting for covariates. Analyses used random-effects regression to account for practice clustering effects. As we found a significant interaction between deprivation quintile and country, we fitted separate models to data from each country to investigate the effect of deprivation on anti-dementia drug prescribing. We repeated analyses to investigate drug continuation. We conducted a sensitivity analysis including only those with a known subtype diagnosis for which medication is recommended (Alzheimer's disease, mixed Alzheimer's and vascular and Lewy Body and Parkinson's disease dementias). We repeated our main analysis in English practices using the 2007 IMD for England instead of Townsend score to measure deprivation. This work was supported by The Dunhill Medical trust (R296/0513).

Table 1. Cohort characteristics at baseline

Characteristics	*n* (%)
Sex	
Male	27,773 (36)
Female	49,272 (64)
Age at baseline	
Median (IQR)	82 (77–87)
Country	
England	59,498 (77)
Scotland	10,231 (13)
Wales	4,712 (6)
Northern Ireland	2,604 (3)
Year of first dementia record	
2002–05	19,074 (25)
2006–09	26,461 (34)
2010–13	31,510 (41)
Townsend quintile	
1 (least deprivation)	18,547 (24)
2	18,114 (24)
3	16,846 (22)
4	14,570 (19)
5 (greatest deprivation)	8,968 (12)

Results

We included 77,045 patients with a record of dementia or an anti-dementia drug prescription, with a median (inter-quartile range [IQR]) follow-up of 1.8 (0.8–3.3) years. Table 1 shows study cohort characteristics. Dementia diagnosis subtype was unspecified for 36,108 (47%) patients; 23,351 (30%) patients had an Alzheimer's or mixed dementia diagnosis; and 15,346 (20%) patients had a vascular dementia diagnosis.

Drug initiation

A total of 28,337 (37%) patients received at least one anti-dementia drug prescription, with an overall drug initiation rate of 23 per 100 person-years. In total, 17,704 (62%) of prescriptions were for donepezil, 3,541 (12%) rivastigmine, 4,232 (15%) galantamine and 2,860 (10%) memantine. The crude drug initiation rate in the most deprived dementia patients was 21.7 per 100 person-years, but 26.1 per 100 person-years in the least deprived (Table 2). Least deprived patients were 25% more likely to be initiated on an anti-dementia drug than the most deprived patients (adjusted incidence rate ratio [IRR] 1.25, 95% confidence interval [CI] 1.19–1.31). Drug initiation rates were higher in younger people and men. Initiation rates were lowest in Wales (IRR 0.68, 95% CI 0.55–0.82) and highest in Northern Ireland (1.81, 1.41–2.34) and Scotland (1.14, 0.98–1.32) (Table 2).

Drug initiation rates appeared to be slightly lower during 2006–09 compared with 2002–05 and 2010–13 in all countries (Figure 1). In English practices, a similar relationship was observed to that seen in the whole UK, with rates of prescribing increasing with decreasing deprivation (least deprived compared with the most deprived group: IRR 1.27, 95% CI 1.20–1.34). In the other UK countries, there was no such relationship between deprivation quintile and prescribing (Table 3). Figure 1 indicates that in Wales, greater deprivation may have been associated with less prescribing before 2010, although from 2010–13, this relationship is no longer evident.

Drug continuation

There was no significant difference in the likelihood of people from different deprivation quintiles receiving anti-dementia drugs for at least 60 days. Continuation rates were similar between countries.

Sensitivity analyses

When we restricted the analysis to people with a known diagnosis for which anti-dementia drugs are indicated (primarily Alzheimer's and mixed dementias): the least deprived had a 7% higher rate of drug initiation than the most deprived group (IRR 1.07, 95% CI 1.01–1.15). Using IMD instead of Townsend score to measure deprivation in England, we observed a similar relationship between deprivation and anti-dementia drug prescribing; the least deprived had a 33% higher rate of drug initiation than the most deprived group (IRR 1.33, 95% CI 1.24–1.41).

Discussion

People with dementia who were least deprived were 25% more likely than the most deprived to be prescribed anti-dementia medication; this was driven by data from English practices, where the least deprived were 27% more likely to be prescribed these drugs. Dementia drug treatments have probably been more available to people who are less deprived, because they better negotiate healthcare systems, and more frequently ask for them [13]; and less available to

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Table 2. Rates and predictors of anti-dementia drug initiation

Characteristics	Rate of drug initiation per 100 person-years	IRR[a] (95% CI)	
		Unadjusted	Adjusted
Sex			
Male	25.0	1	1
Female	22.1	0.87 (0.85–0.89)	0.96 (0.94–0.98)
Age			
per 10 year increase		0.77 (0.76–0.78)	0.76 (0.75–0.77)
Country			
England	22.5	1	1
Scotland	25.8	1.17 (1.02–1.36)	1.14 (0.98–1.32)
Wales	14.2	0.72 (0.59–0.87)	0.68 (0.55–0.82)
Northern Ireland	44.7	1.90 (1.48–2.44)	1.81 (1.41–2.34)
Year			
2002–05	22.5	0.74 (0.72–0.77)	0.72 (0.69–0.74)
2006–09	19.5	0.68 (0.66–0.69)	0.67 (0.65–0.68)
2010–13	25.9	1	1
Townsend quintile			
1 (least deprivation)	26.1	1.24 (1.18–1.30)	1.25 (1.19–1.31)
2	22.9	1.11 (1.06–1.17)	1.14 (1.09–1.20)
3	22.6	1.12 (1.07–1.18)	1.13 (1.08–1.19)
4	20.9	1.06 (1.01–1.12)	1.07 (1.02–1.12)
5 (greatest deprivation)	21.7	1	1

[a]Results from multivariable Poisson regression models, including practice as a random effect. Adjusted IRRs are adjusted for the other covariates shown.
IRR, incidence rate ratio.

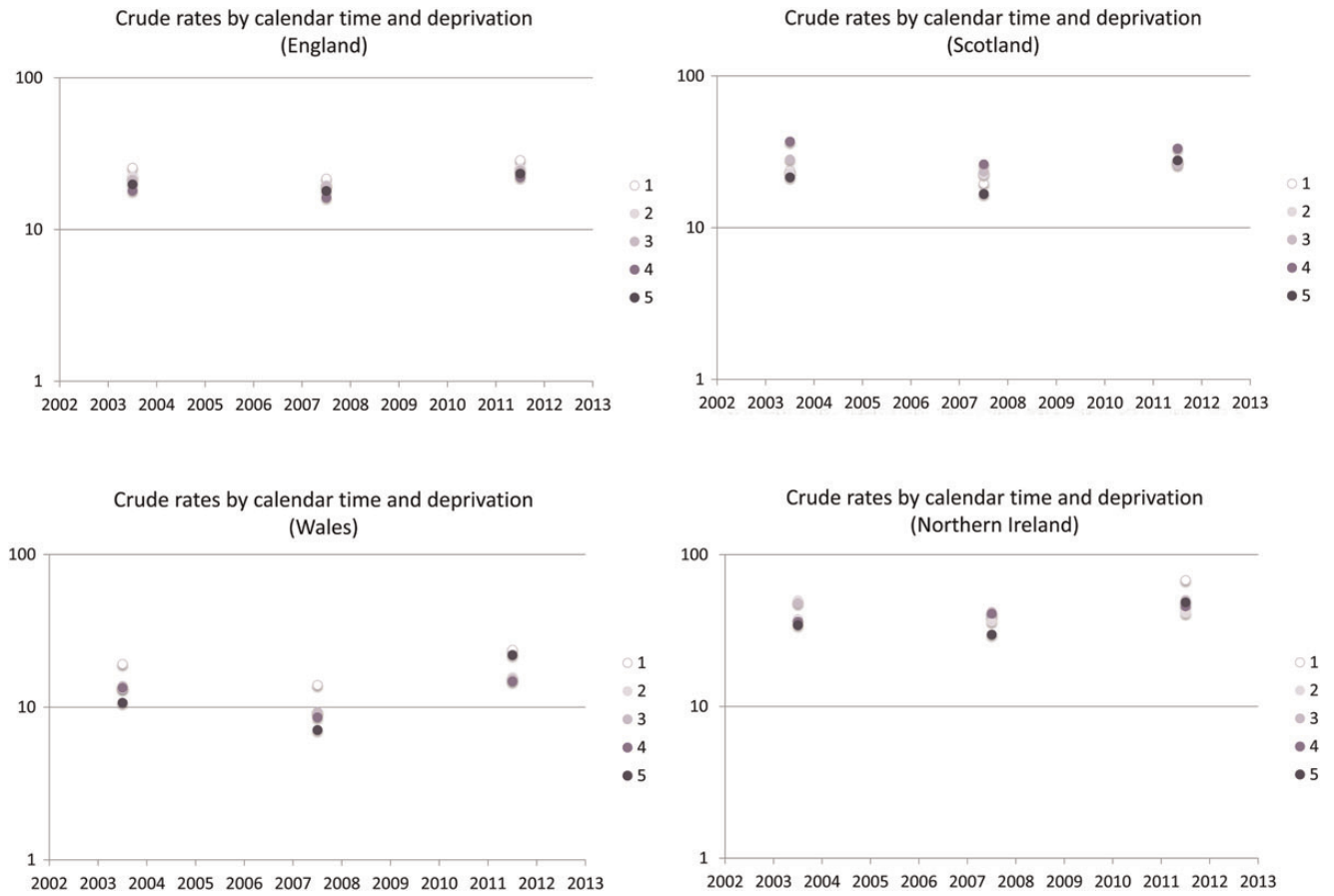

Figure 1. Plots of initiation rates over time by Townsend score and country.

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Table 3. Association between Townsend quintile and anti-dementia drug initiation in the four constituent countries of the UK

Characteristics	England IRR (95% CI)	Scotland IRR (95% CI)	Wales IRR (95% CI)	Northern Ireland IRR (95% CI)
Townsend quintile				
1 (least deprivation)	1.27 (1.20–1.34)	1.15 (1.01–1.30)	1.09 (0.86–1.38)	1.00 (0.84–1.18)
2	1.11 (1.05–1.17)	1.34 (1.21–1.49)	0.94 (0.74–1.19)	1.07 (0.90–1.28)
3	1.09 (1.03–1.16)	1.32 (1.19–1.47)	0.95 (0.76–1.19)	1.16 (0.98–1.37)
4	1.02 (0.96–1.08)	1.30 (1.17–1.44)	0.91 (0.72–1.16)	1.08 (0.89–1.30)
5 (greatest deprivation)	1	1	1	1

Results from multivariable Poisson regression models, including practice as a random effect. IRRs adjusted for sex, age and calendar time.
IRR, incidence rate ratio.

those from more deprived areas, who have on average more morbidity, attend relatively under-resourced practices and are less able to attend appointments, especially in rural areas [12, 23]. These differences are significant, although of a lesser magnitude to those reported in other Western countries [6]. In England, significant inequality remained throughout the decade studied despite the 2010 National Dementia strategy and more inclusive 2009 NICE guidelines [24]. Guidelines can take years to be fully implemented [25], so these policies could be driving inequality reductions not fully realised, although our study extended 4 years after guideline publication. In Wales, there appeared to be less inequality after 2010; this could be a chance finding or indicate that these policies have more effectively reduced inequality in Wales.

People in Northern Ireland with dementia are more likely than those in England to be prescribed anti-dementia drugs, and there was a trend towards more prescribing in Scotland. We hypothesised that the less restrictive Scottish recommendations between 2006 and 2009 might have decreased disparity in their use compared with England, because people with fewer resources are less able to circumvent restrictions [13]. The disparities in treatment availability that we found in English practices were not demonstrated in Scottish or Northern Irish practices. Perhaps the higher overall prescribing rates in Scotland and Northern Ireland helped prevent prescribing inequalities. In Scotland and Northern Ireland, a greater proportion of patients with dementia have a recorded diagnosis, compared with English and Welsh practices, so people with dementia could also be more likely to receive a timely diagnosis in these countries [26].

The proportion of prescribing taking place in primary versus secondary care might be greater in Scotland where, in contrast to England, primary and secondary health care are more integrated, and GPs with experience in dementia may diagnose and initiate treatment [27]. In England and Wales, NICE guidelines recommend specialist initiation [28], so it might be harder for people with dementia, and those with fewer economic resources especially, to access prescribing. The Northern Irish health system is relatively less integrated, however, so integration does not explain our findings from this region.

Levels of investment in health, including memory services, vary between UK countries since devolution. Government health spending is lowest in England and highest in Scotland and Northern Ireland, although these variations have declined over the past decade [29]. We found the lowest overall prescribing rates in Wales, where memory clinic funding per new patient is half that of English memory clinics [30] and fewer dementia cases are diagnosed compared with the other UK countries [7].

Limitations

Having a dementia diagnosis depends on patients presenting and doctors (usually in secondary care) recording a diagnosis. Dementia is under-recorded in GP records [31]. In a UK study higher diagnosis rates were associated with greater practice deprivation, perhaps because deprived groups have more chronic illnesses that are associated with dementia and more frequent GP contact [32]. Multiple morbidity is more common in deprived areas, so perhaps some of the decreased prescribing in these areas might relate to concerns about side effects in those who are more physically frail [12].

We do not know whether the large group of people with subtype dementia unspecified had potentially treatable conditions. Vascular dementia is the most common dementia for which anti-dementia drugs are not indicated, and its prevalence would be expected to be greater in more deprived groups who have higher cardiovascular morbidity [33]. This could explain the lower treatment rates with deprivation; in our sensitivity analyses restricted to those with treatable subtypes, results were in the same direction but of lower magnitude. This is probably because subtype diagnoses are often entered into records when medication is started; in a previous study, people from more deprived groups were more likely to have a diagnosis of dementia subtype unknown [10]. Treatments exclusively in secondary care would have not been detected and this may have happened more to those less deprived, as access to secondary care is probably reduced by deprivation [23], thus excluding this group could underestimate the extent of inequalities. Dementia is the only UK licensed indication for cholinesterase inhibitors, and prescribing for another disorder is unlikely. Some recorded cases of dementia may be misdiagnosed.

The Townsend score characterises deprivation in a particular form: for example it does not measure wealth, social mobility and educational attainment directly. Car ownership

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is included in the score but this may be a less useful deprivation index in urban compared with rural areas, illustrating the importance of a composite measure. Some people will be assigned the wrong deprivation level, because they live in a neighbourhood that is more or less deprived than their personal circumstances, and this is most likely in dense, inner city areas. Care home locations may not reflect the deprivation level of residents, so for the minority of people with dementia who live in care homes, scores may not have been accurate. Townsend scores calculated at the enumeration district level are however strongly correlated with individual deprivation and are similarly predictive of health [34]. The IMD is now most frequently used, but as it cannot be used to directly compare the different UK countries [35], it was not our primary outcome. In our sensitivity analysis, findings using the Townsend and IMD indices were very similar.

Conclusions

People with dementia who were least deprived were 25% more likely than the most deprived to be prescribed anti-dementia medication. This finding appeared to be driven by English practice data, while in Scottish and Northern Irish practices there was no such evidence of inequity. These differences could relate to health policies of the countries, which have diverged since devolution. Higher overall anti-dementia drug prescribing in Scottish and Northern Irish practices and differing clinical guidelines in Scotland from other UK countries might explain apparently greater equality in prescribing in these countries. Strategies to offer treatment to more deprived people with dementia in England are urgently needed. These should focus on increasing the proportion of people with dementia of all severities offered drug treatments, and seeking to ensure that future prescribing policies do not introduce barriers to care that are less penetrable to people from the most deprived areas.

Key points

- Least deprived patients were 25% more likely to be initiated on anti-dementia drugs than the most deprived in the UK.
- We found that there were inequalities by deprivation in anti-dementia drug prescribing in England but not the other UK countries.
- Strategies to offer treatment to more deprived people with dementia in England are needed.

Authors' contributions

All authors devised the study; R.L. undertook all analyses and R.L. and C.C. drafted the paper. All authors were part of the Steering group that managed the study, of which C.C. was Principal Investigator. All authors revised the manuscript critically for intellectual content and approved the final version.

Conflicts of interest

None declared.

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Ethics approval

The data provider of THIN (CSD Medical Research UK) has obtained overall ethical approval from the South East MREC. As we used anonymised routinely collected data in this study, we did not require further ethics approval, but we obtained approval by the THIN Scientific Review Committee. We did not recruit, approach or interview individual patients.

References

1. Matthews FE, Arthur A, Barnes LE *et al*. A two-decade comparison of prevalence of dementia in individuals aged 65 years and older from three geographical areas of England: results of the Cognitive Function and Ageing Study I and II. Lancet 2013; 382: 1405–12.
2. Knapp M, Prince M, Albanese E *et al*. Dementia UK. London: Alzheimer's Society, 2007.
3. NHS Quality Improvement Scotland. Standards for integrated care pathways for mental health, 2007. http://www.emcdda.europa.eu/attachements.cfm/att_231409_EN_UK54_Scotland_Mental%20Health_2007.pdf. (3 November 2015, date last accessed).
4. Duthie AC, Banerjee S. Use of anti dementia medications in Scotland: Views of old age psychiatrists. GeroPsych 2011; 24: 53–7.
5. Mukadam N, Livingston G, Rantell K, Rickman S. Diagnostic rates and treatment of dementia before and after launch of a national dementia policy: an observational study using English national databases. BMJ Open 2014; 4: e004119.
6. Martinez C, Jones RW, Rietbrock S. Trends in the prevalence of antipsychotic drug use among patients with Alzheimer's disease and other dementias including those treated with anti-dementia drugs in the community in the UK: a cohort study. BMJ Open 2013; 3: e002080.
7. Alzheimer Society. Mapping the Dementia Gap. London: Alzheimer's Society, 2013. http://www.alzheimers.org.uk/site/scripts/documents_info.php?documentID=2165. (3 November 2015, date last accessed).
8. Cooper C, Tandy AR, Balamurali TBS, Livingston G. A systematic review and metaanalysis of ethnic differences in use of dementia treatment, care and research. American Journal of Geriatric Psychiatry 2010; 18: 193–203.
9. Zilkens RR, Duke J, Horner B, Semmens JB, Bruce DG. Australian population trends and disparities in cholinesterase inhibitor use, 2003 to 2010. Alzheimers Dement 2014; 10: 310–8.

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10. Cooper C, Blanchard M, Selwood A, Livingston G. Antidementia drugs: prescription by level of cognitive impairment or by socio-economic group? Aging Mental Health 2010; 14: 85–9.
11. Matthews FE, McKeith I, Bond J, Brayne C. Reaching the population with dementia drugs: what are the challenges? Int J Geriatr Psychiatry 2007; 22: 627–31.
12. Mercer SW, Guthrie B, Furler J, Watt GCM, Hart JT. Multimorbidity and the inverse care law in primary care. Br Med J 2012; 344: e4152.
13. Seddon N. Quite Like Heaven? Options for the NHS in A Consumer age. London: Civitas: Institute for the Study of Civil Society, 2007.
14. Lis Y, Mann RD. The VAMP Research multi-purpose database in the U.K. J Clin Epidemiol 1995; 48: 431–43.
15. British Medical Association. General Practice in the UK - background briefing, 2014. http://www.google.co.uk/url?url=http://bma.org.uk/-/media/files/word%2520files/news%2520views%2520analysis/press%2520briefings%2520new/bmabrief_generalpractice.docx&rct=j&frm=1&q=&esrc=s&sa=U&ved=0CBoQFjABahUKEwjr55KviPTIAhVM1RoKHXoxCvk&usg=AFQjCNEEwhBHJYU-NKhrOB8oJAdlZJfdsw. (3 November 2015, date last accessed).
16. Blak BT, Thompson M, Dattani H, Bourke A. Generalisability of The Health Improvement Network (THIN) database: demographics, chronic disease prevalence and mortality rates. Informatics in primary care, 2011;19: 251–5.
17. Booth N. What are the Read Codes? Health Libraries Review 1994; 11: 177–82.
18. Horsfall L, Walters K, Petersen I. Identifying periods of acceptable computer usage in primary care research databases. Pharmacoepidemiol Drug Saf 2013; 22: 64–9.
19. Maguire A, Blak BT, Thompson M. The importance of defining periods of complete mortality reporting for research using automated data from primary care. Pharmacoepidemiol Drug Saf 2009; 18: 76–83.
20. Townsend P, Phillimore M, Beattie A. Health and Deprivation: Inequality and the North. London: Croom Helm Ltd, 1988.
21. UK government. Index of Multiple Deprivation. UK government, 2015. http://data.gov.uk/dataset/index_of_multiple_deprivation_imd_2007. (3 November 2015, date last accessed).
22. Amuah JE, Hogan DB, Eliasziw M *et al.* Persistence with cholinesterase inhibitor therapy in a population-based cohort of patients with Alzheimer's disease. Pharmacoepidemiol Drug Saf 2010; 19: 670–9.
23. Qian WN, Schweizer TA, Fischer CE. Impact of socio-economic status on initial clinical presentation to a memory disorders clinic. Int Psychogeriatrics 2014; 26: 597–603.
24. Department of Health. The National Dementia Strategy, 2009. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/168220/dh_094051.pdf. (3 November 2015, date last accessed).
25. National Institute for Clinical Excellence (NICE). How to change practice, 2007. http://www.nice.org.uk/media/default/about/what-we-do/into-practice/support-for-service-improvement-and-audit/how-to-change-practice-barriers-to-change.pdf. (3 November 2015, date last accessed).
26. Deparment of Health SSaPS. Improving dementia services in northern Ireland. A Regional Strategy, 2011. http://www.dhsspsni.gov.uk/improving-dementia-services-in-northern-ireland-a-regional-strategy-november-2011.pdf. (3 November 2015, date last accessed).
27. Healthcare improvement Scotland. Healthcare Improvement SCOTLAND, 2014. http://www.healthcareimprovementscotland.org/our_work/technologies_and_medicines/mta_resources/appraisal_217.aspx. (3 November 2015, date last accessed).
28. National Institute for Health and Clinical Excellence (NICE). Alzheimer's disease - donepezil, galantamine, rivastigmine and memantine, 2011. Report No. TA 217.
29. Nuffield trust. Health Care Spending per Person in the UK, 2015. http://www.nuffieldtrust.org.uk/data-and-charts/health-spending-head-country. (3 November 2015, date last accessed).
30. Public Health Wales. Wales National Audit Memory Clinic and Memory Assessment Services. Public Helath Wales, 2014. https://www.rcpsych.ac.uk/pdf/Wales%20National%20Audit%20-%20Memory%20Clinics%20Aug%202014.pdf. (3 November 2015, date last accessed).
31. Rait G, Walters K, Bottomley C, Petersen I, Iliffe S, Nazareth I. Survival of people with clinical diagnosis of dementia in primary care: cohort study. Br Med J 2010; 341: c3584.
32. Connolly A, Gaehl E, Martin H, Morris J, Purandare N. Underdiagnosis of dementia in primary care: variations in the observed prevalence and comparisons to the expected prevalence. Aging Mental Health 2011; 15: 978–84.
33. Clark AM, DesMeules M, Luo W, Duncan AS, Wielgosz A. Socioeconomic status and cardiovascular disease: risks and implications for care. Nat Rev Cardiol 2009; 6: 712–22.
34. Adams J, Ryan V, White M. How accurate are Townsend Deprivation Scores as predictors of self-reported health? A comparison with individual level data. J Public Health 2005; 27: 101–6.
35. Payne RA, Abel GA. UK indices of multiple deprivation—a way to make comparisons across constituent countries easier. Health Statistics Quart 2012; 53. http://www.ons.gov.uk/ons/rel/hsq/health-statistics-quarterly/no–53–spring-2012/uk-indices-of-multiple-deprivation.html. (3 November 2015, date last accessed).

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