The rural dispensing practice – better medication adherence and clinical outcomes compared to non-dispensing practices? A cross-sectional analysis of routine data

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2540 words

Abstract

Background

Most patients obtain medications from pharmacies by prescription, but rural general practices can dispense medications. Clinical implications of this difference in drug delivery are unknown. We hypothesised that dispensing status may be associated with better medication adherence. This could impact intermediate clinical outcomes dependent on medication adherence in, for example, hypertension or diabetes.

Aim

We investigated whether dispensing status is associated with differences in achievement of Quality and Outcome Framework (QOF) indicators that rely on medication adherence.

Design and Setting

Cross-sectional analysis of QOF data for 7,392 general practices in England.

Method

We analysed QOF data from 2016/17 linked to dispensing status for general practices with list sizes ≥1000 in England. QOF indicators were categorised according to whether their achievement depended on a record of prescribing only, medication adherence, or neither.

We estimated differences between dispensing and non-dispensing practices using mixed-effects logistic regression adjusting for practice population age, sex, deprivation, list size, single-handed status and rurality.

Results

Data existed for 7,392 practices; 1,014 (13.7%) could dispense. Achievement was better in dispensing practices than in non-dispensing practices for seven of nine QOF indicators dependant on adherence, including blood pressure targets. Only one of ten indicators dependent on prescribing but not adherence displayed evidence of a difference; indicators unrelated to prescribing showed a trend towards higher achievement by dispensing practices.

Conclusion

Dispensing practices may achieve better clinical outcomes than prescribing practices. Further work is required to explore underlying mechanisms for these observations, and to directly study medication adherence rates.

248 words

How this fits in

- Around 15% of prescriptions given out by general practitioners do not get dispensed by pharmacies.

- In dispensing general practices, medications are usually dispensed, as opposed to prescriptions being issued to patients.

- We hypothesised that this organisational difference may promote greater medication adherence for patients of dispensing practices by streamlining the issuing of medications.

- We studied Quality and Outcome Framework indicators and found higher achievement levels of blood pressure, and other targets, for dispensing than for non-dispensing practices. Further study is required to establish the mechanisms contributing to these findings.

Clinical impact

Dispensing practices show greater achievement of QOF targets dependent on medication adherence than non-dispensing practices.

Introduction

In some countries medications are both dispensed in pharmacies and issued directly to patients at primary care sites. United Kingdom (UK) general practices can hold contractual rights to dispense medication to patients who live more than 1 mile (1.6 km) from the nearest registered pharmacy. [1-3] Such d*ispensing practices* are predominantly rural, where geographical barriers to alternative sources of medication and health care co-exist.[4] Both rurality, and general practitioners' (GPs) dispensing of medications may affect quality of care and health outcomes.[5] Demographically, rural populations have slightly higher life expectancy, with higher proportions of elderly in comparison to urban areas.[6 7] Dispensing practices are less likely to be single handed,[8] and have shorter opening times than pharmacies. Historically, trained dispensers have run primary care dispensaries, however pharmacists are increasingly becoming integrated members of the primary health care team in all types of practices.[9 10] In dispensing practice patient records of allergies and co-morbidities are fully accessible to pharmacists and dispensers.[10] Importantly, patients of dispensing practices can leave in possession of their prescribed medication, whereas in prescribing practices they leave with a prescription for dispensing elsewhere by a registered pharmacy. This raises the hypothesis that adherence to prescribed medications may be greater for patients of dispensing practices in comparison to non-dispensing practices, by virtue of streamlined access to medications.

Non-adherence to prescription medication is a major cause of non-response to treatment. Between 11% and 19% of prescriptions are not actually dispensed to the patient, and barriers to medication possession exist at patient, doctor, and healthcare system levels.[11] Easy access to on-site pharmacy services may improve medication uptake and adherence,[12,13] overcoming logistical barriers that keep patients from presenting their prescriptions elsewhere.[14] These barriers are reduced or absent when patients attend dispensing practices. Patients' medication beliefs,[15] and concerns about taking medication,[16-18] also play a role in medication adherence. A collaborative patient-physician relationship may be key to achieving positive beliefs about treatment and increasing adherence.[19,20] incorporating the act of, or discussion of, dispensing into consultations may modify patients' beliefs, since patients report higher levels of trust in their GPs than in community pharmacists.[21] Furthermore, GPs are more likely to be aware of patients' personal and medical circumstances than pharmacists, therefore they may better tailor their information to patients' needs, taking account of issues such as health literacy.[22,23]

Reduced logistical barriers, opportunities to address patients' beliefs and tailoring of information to the patients' needs may thus all influence medication adherence. However, no research has yet investigated how the dispensing status of practices may impact clinical outcomes dependent on good medication adherence. We hypothesised that on-site dispensing of medication may overcome some barriers to medication possession in comparison to the giving of a prescription. Medication adherence is not systematically recorded in primary care, but National Health Service (NHS) Quality and Outcome Framework (QOF) indicators are. QOF indicators include some measures of intermediate outcomes whose achievement is dependent on medication adherence, others where

achievement reflects prescribing irrespective of adherence, and a third group where achievement is unrelated to prescribing. Therefore we investigated how dispensing practices differ from non-dispensing practices in demographic profile, and sought to establish whether dispensing status is independently associated with better clinical outcomes, defined as higher achievement of QOF indicators that depend on medication adherence in comparison to other groups of indicators.

Methods

Study design and setting

We undertook cross-sectional analyses of QOF clinical indicator data from 2016/17, obtained from NHS Digital and linked it to Dispensing Practice data from March 2017, obtained from the NHS Business Services Authority. Data from March 2017 on practice population age, sex, practice list size, practice deprivation and workforce were also obtained from NHS Digital.[24,25] Practices were classified as rural or urban using Office for National Statistic classification based on the postcodes.[26] Datasets were linked to QOF and dispensing status using practice codes. All data are in the public domain thus no ethical approval was required.

Outcome measures

We classified QOF performance indicators into three groups according to their relation to prescribing: Group 1 were dependent on medication adherence, requiring the taking of a medication, for example indicators reporting percentages of patients meeting pre-specified blood pressure targets; Group 2 were achieved by evidence of *prescription* of a medication (regardless of adherence), for example indicators reporting percentage of patients with coronary heart disease with a record of antiplatelet or anticoagulant prescribing within the preceding year). The remaining QOF indicators were unrelated to specific medications (Group 3), for example the percentage of patients with stroke referred for further investigation. Group classification of indicators was achieved through consensus by discussion between three authors (MG-C, GA and CEC).

Given organisational differences in the processes of obtaining medication between dispensing and non-dispensing practices, and our hypothesis that these differences may affect medication adherence, we expected greater achievement of indicators in group 1 by dispensing practices compared to non-dispensing practices, whilst indicators from group 2 to should show no consistent differences. Thus group 2 represented a control set of indicators subject to any underlying trends according to dispensing status except differences in medication adherence. Group 3 provided further information on any underlying trends.

Statistical analysis

The raw counts of eligible patients (i.e. all patients fitting the corresponding indicator criterion, including those reported as exceptions) and of patients achieving each indicator in the QOF data, were used. QOF business rules allow doctors to report as exceptions certain patients from any indicator so that practices are not penalised financially for inappropriate reasons. Raw figures include any patients subsequently excluded through the exception reporting process. Thus raw data overcome any risk of bias due to variation in rates of exception reporting between practices. Similarly, missing data were not an issue since all people on a disease register were included in the denominator whether or not they had the appropriate outcome recorded.

For each indicator we fitted unadjusted and adjusted mixed-effects grouped logistic regression models with numbers of patients at each practice achieving the indicator as numerator and the number of eligible patients at each practice as denominator. Type of

practice (dispensing/not dispensing) was included as a fixed effect with practice as random effects. Adjusted models included the following practice level population characteristics: percentage of practice population aged ≥65, sex distribution, practice deprivation score, list size, single-handed status and rurality.[27] Analyses were restricted to practices with list sizes ≥1000.

Results

Data existed for 7,392 practices and 1,014 (13.7%) had dispensing status. Dispensing practices had more patients aged ≥65, fewer deprived patients, were less often single-handed, were more often rurally located, and had slightly larger list sizes when compared with non-dispensing practices (Table 1).

Group 1: prescribing indicators dependent on adherence

In adjusted and unadjusted models, the odds ratio (OR) for association with dispensing status was greater than one for all nine indicators, indicating higher achievement in dispensing practices. In unadjusted analyses, this only failed to reach significance for one indicator: percentage of patients with diabetes having total cholesterol ≤ 5 mmol/L (OR 1.01, (95% confidence interval (CI) 0.99 to 1.03; *P* = 0.22; Table 2).

After adjustment there were minor changes in ORs for most indicators. Substantial attenuation of differences in achievement for the three indicators related to HbA1c levels was observed; two of these had *P*-values > 0.05: percentage of patients with diabetes whose last HbA1c was ≤ 59 mmol/mol (OR 1.01 (0.98 to 1.03); *P* = 0.57) and ≤ 64 mmol/mol (OR 1.02 (0.99 to 1.04); *P* = 0.22). For the remaining seven indicators, achievement was greater for dispensing practices than non-dispensing practices. These included blood pressure targets in hypertension, coronary heart disease, peripheral arterial disease, cerebrovascular disease and diabetes, achievement of diabetes targets for cholesterol lowering and for the highest threshold (≤75 mmol/mol) for HbA1c (Table 2; Figure 1).

Group 2: prescribing indicators independent of adherence

In contrast to group 1, unadjusted ORs for the ten prescribing indicators independent of adherence showed no consistency in direction. Only two indicators had ORs >1 indicating with half of the differences showing lower achievement (P<0.05). After adjustment the range of ORs was narrower and largely non-discriminatory; we only observed one statistically significant difference between dispensing and non-dispensing practice: the percentage of patients with atrial fibrillation being prescribed anticoagulants (OR 1.06 (1.03 to 1.10); *P* < 0.001; Table 3, Figure 2).

Group 3: prescribing indicators unrelated to medication

There were 27 further QOF indicators not included in the above analyses. ORs in the adjusted analyses showed an overall trend towards higher achievement by dispensing practices (only three ORs being <1); ORs were significantly >1 for 13 (48%) indicators and < 1 for none (Supplementary Table 1).

Discussion

Summary

To our knowledge, this is the first study to consider the impact of primary care dispensing status on differential achievement of QOF indicators for chronic conditions. We found evidence for greater achievement by dispensing practices for seven of the nine QOF indicators that depend on adherence to medications. In contrast, a difference according to dispensing status was only observed in one of ten indicators dependent on prescribing but not adherence. Where indicator achievements were unrelated to prescribing, almost half of them were better achieved in dispensing practices. These findings are based on analysis of primary care data for England; they are directly relevant to other UK health services, as well as to other countries where access to medications is co-located with primary health care settings.

Strengths and limitations

This large study analysed data covering over 7,000 practices in England and is thus representative of the country and of the UK. We examined the full set of current QOF clinical indicators in unadjusted and adjusted models. We have previously observed the impact of exception reporting on net achievement of QOF indicators, therefore we only analysed raw achievement rates to avoid potential bias due to differences in exception reporting.[9,28]

This practice-level observational analysis of routine data did not include any direct measures of individual medication adherence, only intermediate outcomes known to depend on good adherence. Medication adherence is affected by individual as well as organisational factors and we cannot be sure that our findings reflect impacts on individuals. The observed trends towards greater achievement in dispensing practices of QOF indicators unrelated to prescribing (group 3), suggest that other organisational characteristics of dispensing practices such as continuity of care, which could not be adjusted for in our analyses, may also be important.[29] Residual confounding due to this, and other unknown and/or unadjusted factors, is highly likely to be implicated in our findings.[30] Therefore we do not interpret these findings as clear evidence of differences in medication adherence rates according to practice dispensing status. The results are, however, consistent with our hypothesis that leaving a consultation with a medication, rather than with a prescription which may or may not be dispensed, removes one barrier to medication possession and therefore may plausibly affect medication adherence.

Comparison with existing literature

Practice characteristics previously associated with greater achievement of QOF indicators in Scotland have included higher deprivation levels, lower income from non NHS sources, younger ages of GPs and larger sizes of practice teams.[31] The rural workforce tends to be older;[32] we found lower rates of deprivation and single handed status amongst dispensing practices in the current study, therefore lower rather than higher underlying achievement of QOF indicators might have been predicted in dispensing practices, however no trend in either direction was evident from our control indicators, whilst adherence indicators

uniformly showed higher achievement with dispensing. Evidence relating deprivation to QOF achievement is mixed; associations are weak in magnitude, and complex in nature when other barriers to access for the most disadvantaged are accounted for.[28,33,34] It has also been observed that generic indices of deprivation cannot reflect true levels of deprivation in rural areas due to wide heterogeneity of deprivation within such settings.[35]

Our findings cannot readily be explained by any systematic differences in quality of care between dispensing and non-dispensing practices, although the trend to higher achievement of indicators unrelated to prescribing suggests that there may be underlying characteristics of dispensing practices, their patients, or both, contributing to these complex outcomes. Remoteness from urban centres, strongly correlated with dispensing status, does not correlate to a range of measures of quality of care.[36] Historically dispensing practice has been associated with lower generic prescribing rates and higher drug unit costs than non-dispensing practice.[37,38] We found no evidence for higher rates of prescribing per se in association with dispensing status, thus the "perverse incentive" (now largely mitigated against anyway within the current GP contract) does not account for our findings either. It follows from our hypothesis that dispensing practice drug costs overall will appear to be higher due to improved medication collection alone, in comparison with non-dispensing practices. In fact, by demonstrating greater achievement of targets for intermediate outcomes such as blood pressure, fewer cardiovascular events and deaths might be predicted. Therefore to consider drug costs of dispensing practices in isolation, without health economic assessment inclusive of outcomes is potentially misleading.[38,39]

Estimates of proportions of prescriptions issued but not dispensed vary widely; the median rate is around 15%.[11,40] On-site provision of medication is a distinguishing feature of dispensing practices. Co-location of pharmacies within care settings can improve medication uptake and adherence,[13] and logistical barriers to medication possession are lower where prescriptions can be dispensed on site or within easy geographical proximity.[14] Despite adjusting our findings for recognised co-variates of QOF outcomes we recognise that residual confounding was possible. However, our findings seem consistent with the hypothesis that dispensing practices achieve higher rates of medication adherence due to greater ease of access.

Implications for research and/or practice

Although barriers to integration of community pharmacy services with primary care exist,[41] pharmacist engagement in primary care is rising, with roles beyond medication advice, increasingly including elements of direct patient care.[9,42] Pharmacist led care can improve medication adherence in long-term conditions such as hypertension,[43,44] and such interventions are cost and time saving for GPs.[45,46] Community pharmacies are being increasingly co-located with, and/or managed by, primary care teams. Such proximity should facilitate medication adherence. This trend might lead to erosion, in time, of the differences in QOF achievement that we have observed here. The impact of financial incentives on achievement of these quality indicators is also important and may confound time-dependent trends in differences in medication adherence.[47] We have not found any evidence addressing the impact of expanding numbers of pharmacies co-located with

surgeries on outcomes such as adherence. Further research on this topic could provide new insights into the importance of ready access to medications, irrespective of the right to dispense medications.

Conclusions

Dispensing directly to patients removes one barrier to medication possession in comparison to prescribing alone. Our findings offer initial evidence that dispensing of drugs may result in better intermediate clinical outcomes, as assessed by a range of QOF indicators, in comparison to prescribing alone. A range of organisational and individual factors, which we could not adjust for, may well contribute to our observations. The findings are consistent with our hypothesis that differences may be mediated through improved medication adherence, however we were unable to directly measure adherence. Further work is required to clarify the possible underlying mechanisms for and significance of these observations, incorporating adherence measures, and to assess the implications for other models of primary care dispensing such as on-site pharmacies.

Acknowledgements

Data sharing statement

All data used are in the public domain: QOF and NHS Business Authority data can be accessed as referenced.[24,25]

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Legends for tables and figures

Table 1 - Characteristics of dispensing and non-dispensing practices in England

Table 2 - Associations of group 1 outcomes – those dependent on medication adherence with dispensing status

Table 3 - Associations of group 2 outcomes - those independent of medication adherence with dispensing status

Figure 1 - Differences (OR) between dispensing and non-dispensing practices in outcomes dependent on adherence to medication

Figure 2 – Differences (OR) between dispensing and non-dispensing practices in outcomes dependent on prescription but not adherence

	Dispensing (n=1,014)	Not dispensing (n=6,378)	Total (n=7,392)
Age over 65 sample median % (IQR)	23.7 (20.9 – 26.9)	16.2 (11.3 – 20.3)	17.3 (12.2 – 21.6)
Males sample median % (IQR)	49.4 (48.8 – 50.0)	49.8 (48.9 – 51.1)	49.7 (48.9 – 50.9)
Single-handed practices N (%)	28 (2.8)	476 (7.5)	504 (6.8)
IMD least deprived N (%)	424 (42.4)	1,004 (16.4)	1,420 (20.0)
Rural N (%)	717 (70.7)	375 (5.9)	1,092 (14.8)
List size median (IQR)	7,016 (4,538 – 10,558)	6,795 (4,200 – 10,096)	6,825 (4,245 – 10,169)

Table 1 - Characteristics of dispensing and non-dispensing practices in England

		Dispensing	Not dispensing	Unadjusted		Adjusted	
Code	Indicator	Median % (IQR)	Median % (IQR)	OR (CI)	*P*-value	OR (CI)	*P*- value
CHD002	Percentage of patients with coronary heart disease whose last blood pressure is ≤ 150/90 mmHg	90.5 (87.6-92.7)	90.1 (86.4, 92.8)	1.08 (1.04, 1.12)	< 0.001	1.10 (1.05, 1.15)	< 0.001
HYP006	Percentage of patients with hypertension whose last blood pressure is ≤ 150/90 mmHg	82.2(78.6,85.2)	80.5 (76.9, 83.7)	1.12 (1.09, 1.15)	< 0.001	1.07 (1.04, 1.11)	< 0.001
PAD002	Percentage of patients with peripheral arterial disease whose last blood pressure is ≤ 150/90 mmHg	88.2 (83.6, 92.0)	88.2 (82.5, 92.7)	1.06 (1.02, 1.11)	0.008	1.11 (1.05, 1.17)	< 0.001
STIA003	Percentage of patients with a history of stroke or transient ischaemic attack whose last blood pressure is ≤ 150/90 mmHg	85.8 (82.3, 89.1)	85.1 (80.8, 88.9)	1.07 (1.04, 1.10)	< 0.001	1.07 (1.03, 1.11)	0.001
DM002	Percentage of patients with diabetes whose last blood pressure is ≤ 150/90 mmHg	88.7 (85.6, 91.6)	87.6 (83.8, 90.8)	1.12 (1.08, 1.15)	< 0.001	1.10 (1.06, 1.15)	< 0.001
DM004	Percentage of patients with diabetes whose last total cholesterol is ≤ 5 mmol/L	70.3 (66.1, 73.6)	69.9 (65.6, 73.9)	1.01 (0.99, 1.03)	0.22	1.03 (1.00, 1.06)	0.035
DM007	Percentage of patients with diabetes whose last HbA1c is ≤ 59 mmol/mol	64.3 (60.2,68.4)	61.6 (57.1, 66.1)	1.12 (1.10, 1.14)	< 0.001	1.01 (0.98, 1.03)	0.57
DM008	Percentage of patients with diabetes whose last HbA1c is ≤ 64 mmol/mol	72.8 (69.0, 76.3)	69.5 (65.0, 73.6)	1.18 (1.15, 1.20)	< 0.001	1.02 (0.99, 1.04)	0.22
DM009	Percentage of patients with diabetes whose last HbA1c is ≤ 75 mmol/mol	84.1 (80.9, 86.6)	80.3 (76.2, 83.8)	1.28 (1.25, 1.31)	< 0.001	1.04 (1.01, 1.08)	0.003

Table 2 - Associations of group 1 outcomes – those dependent on medication adherence with dispensing status

	Indicator	Dispensing	Not dispensing	Unadjusted		Adjusted	
		Median % (IQR)	Median % (IQR)	OR (CI)	*P*-value	OR (CI)	*P*-value
AF007	Percentage of patients with atrial fibrillation and CHA2DS2-VASc score ≥ 2 treated with anti-coagulants	82.7 (79.0, 86.4)	81.2(76.2, 85.7)	1.12 (1.09, 1.15)	< 0.001	1.06 (1.03, 1.10)	< 0.001
CHD005	Percentage of patients with coronary heart disease prescribed anti-platelet agent or an anti-coagulant	92.5 (90.2, 94.4)	92.7 (90.0, 94.8)	1.01 (0.97, 1.04)	0.75	1.07 (0.92, 1.24)	0.36
HF003	Percentage of patients with left ventricular systolic dysfunction prescribed an ACE-I or ARB	84.8 (77.8, 91.7)	86.2 (78.3, 100)	0.95 (0.90, 0.99)	0.017	0.97 (0.92, 1.03)	0.34
HF004	Percentage of patients with left ventricular systolic dysfunction, treated with an ACE-I or ARB, also being prescribed a beta-blocker licensed for heart failure	80.0 (70.0, 88.9)	81.8 (72.7, 93.6)	0.91 (0.86, 0.95)	< 0.001	1.02 (0.96, 1.08)	0.58
PAD004	Percentage of patients with peripheral arterial disease prescribed aspirin or other antiplatelet agent	88.5 (83.7, 92.3)	88.9 (83.3, 93.6)	0.92 (0.82, 1.02)	0.11	1.04 (0.99, 1.11)	0.14
STIA007	Percentage of patients with non-haemorrhagic stroke or TIA prescribed antiplatelet agent or oral anti-coagulant	92.5 (90.0, 94.7)	92.7 (89.4, 95.6)	1.00 (0.97, 1.04)	0.87	1.03 (0.98, 1.08)	0.24
DM006	Percentage of patients with diabetic nephropathy or micro-albuminuria, prescribed an ACE-I or ARB	80.8 (74.4,87.5)	82.1 (75.0, 88.9)	0.92 (0.88, 0.96)	< 0.001	0.97 (0.92, 1.03)	0.29
OST002	Percentage of patients with previous fragility fracture, and osteoporosis on DEXA scanning, prescribed a bone-sparing agent	85.7 (66.7, 100)	100 (66.7, 100)	0.93 (0.86, 1.01)	0.080	1.10 (1.00, 1.21)	0.053
OST005	Percentage of patients with previous fragility fracture and osteoporosis prescribed a bone-sparing agent	66.7 (54.6, 89.7)	75.0 (57.1, 100)	0.88 (0.82, 0.93)	< 0.001	0.96 (0.88, 1.03)	0.26
CVD-PP001	Percentage of patients newly diagnosed with hypertension, with QRISK2 score ≥20%, prescribed a statin	62.5 (50.0, 83.3)	75.0 (50.0, 100)	0.68 (0.63, 0.73)	< 0.001	0.95 (0.87, 1.04)	0.26

Table 3 - Associations of group 2 outcomes - those independent of medication adherence with dispensing status
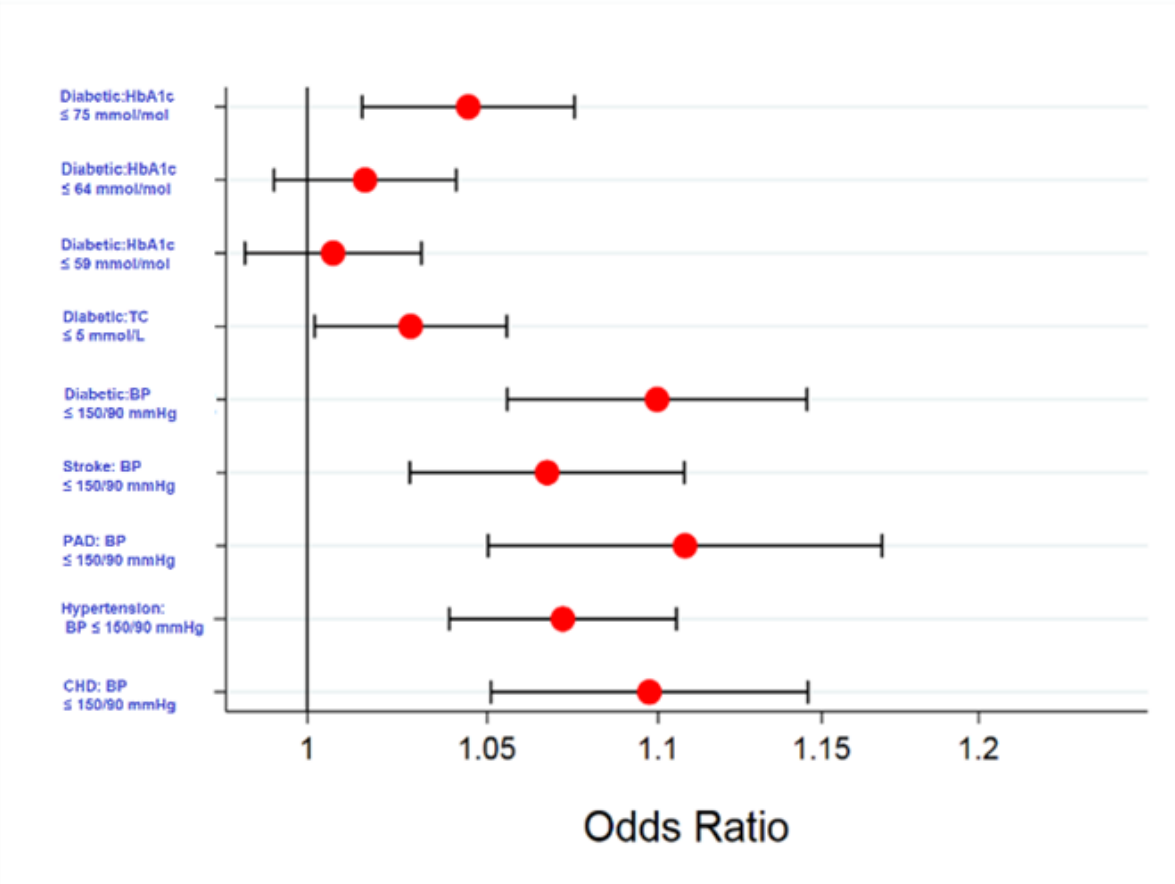
Figure 1 - Differences (OR) between dispensing and non-dispensing practices in outcomes dependent on adherence to medication
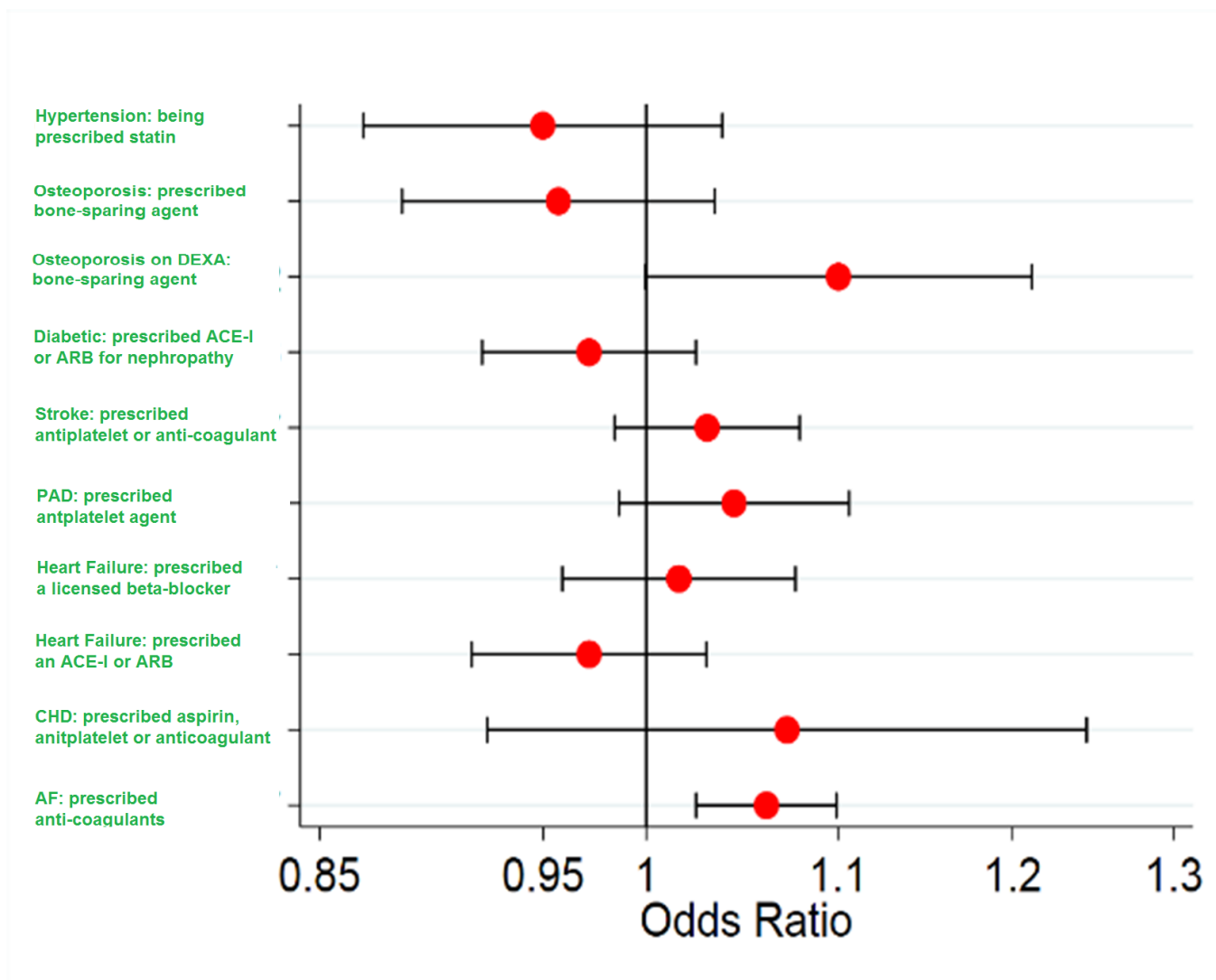
Figure 2 – Differences (OR) between dispensing and non-dispensing practices in outcomes dependent on prescription but not adherence