Physicians are more likely than non-physicians to use brand-name drugs to treat their chronic conditions

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► Additional material is published online only. To view the files please visit the journal online (http://dx.doi.org/10.1136/jech-2016-208837).

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Received 20 December 2016
Revised 27 March 2017
Accepted 11 May 2017
Published Online First 3 July 2017

ABSTRACT

Background Little is known about the treatments physicians choose for themselves compared with how they treat their patients. We determine if physicians prescribe different treatments to patients than to themselves.

Methods Population-based cohort study from 2004 to 2012 examining prescription claims of all Danish primary care physicians (PCP; n=3088) and all other Danish adults (n=2 334 590) who received a first-time prescription from a PCP for a statin (n=455 586), calcium channel blocker (CCB, n=330 369), serotonin-norepinephrine/selective serotonin reuptake inhibitors (SN/SSRIs, n=423 740), proton pump inhibitor (PPI, n=671 965) or antihistamine (n=456 018). The main outcome is the brand-name or generic status of the first prescribed drug. A logistic regression model compared outcomes, unadjusted and adjusted for sociodemographic characteristics and coverage information.

Results For drugs that require chronic treatment (statins, CCBs, SN/SSRIs), the relative risk (RR) for PCPs (PCP patients) being treated with a brand drug was 3.86 (95% CI 3.33 to 4.47; p<0.001). This difference remained significant when adjusting for covariates (adjusted RR=2.51 (95% CI 2.16 to 2.92; p<0.001)). For non-chronic drugs (PPIs, antihistamines), the RR for PCP patients was (RR=1.13 (95% CI 1.08 to 1.20; p<0.001)), and this difference was explained by higher income. Physicians are not more likely than non-physicians, however, to be treated with brand-name versions of drugs that are available as generics.

Conclusion Physicians are more likely than non-physicians to be treated with brand-name drugs without generic equivalents in three chronic treatment drug classes but not in two acute treatment drug classes. Guidelines can lead to lower brand-name drug use than physicians prefer for themselves.

INTRODUCTION

The patent expirations of blockbuster drugs for many diseases have created wide price differentials between similar, commonly prescribed drugs. To contain costs, a growing number of health systems recommend or require physicians to use 'step therapy'—to start new patients on well-established generic drugs and only try more expensive drugs if initial therapy fails. Yet, little is known about how often these recommendations compel patients to start with drugs that their physicians would not choose for themselves.

This paper uses a 'revealed preference' approach that compares the drugs Danish physicians use for their own treatment to those they prescribe to their patients. To the extent that we see differential treatment patterns, our results confirm other research showing that physicians are imperfect agents for their patients.[1–6] Specifically, if they are constrained in how often they can deviate from the recommended step therapy to prescribe their preferred drugs, they are more likely to 'bend the rules' for their own benefit than that of their patients. In addition, studying the drugs physicians themselves use can shed light on their perceptions of different drugs' comparative efficacy.

In Denmark, a universal healthcare system ensures that doctors and their patients faced the same prescription drug subsidies,[7] and lack of easy access to drug samples guarantees that physicians' drug utilisation was fully observed.[8] As in other countries, drug companies use detailing and journal advertising to promote their products to physicians, but direct-to-consumer advertising is forbidden. The Danish Institute for Rational Pharmacotherapy (IRP) and local health authorities promote prescribing guidelines that emphasise first-line use of generic drugs.

While the health and healthcare choices of physicians have been studied in other domains such as smoking, caesarean sections and end-of-life care, this is the first large-scale study to examine physicians' use of generic versus brand-name prescription drugs compared with what they prescribe to their patients.

METHODS

We used unique data matching primary care physicians (PCPs) to the drugs they purchased for their own use. From the Danish National Prescription Registry, we obtained all purchases of 3-hydroxy-3-methylglutaryl coenzyme A (HMG-CoA) reductase inhibitors (statins), calcium channel blockers (CCBs), serotonin-norepinephrine/selective serotonin reuptake inhibitors (SN/SSRIs), proton pump inhibitors (PPIs) and antihistamines over the period 2000–2012. The data contained drug identifiers (anatomical therapeutic chemical classification system (ATC)), purchase date, quantity, price, out-of-pocket (OOP) payment, unique patient identifiers and prescriber's clinic ID (identifying where each prescription was written). We also used data on drug fills outside of these selected drug classes to compute, for each individual, the number of different therapeutic drug groups (ATC level 2) used in the past year, as one proxy for health status. Linked medical claims from hospital visits (both inpatient and outpatient) included ICD-10 (10th revision of the International

To cite: Carrera M, Skipper N. *J Epidemiol Community Health* 2017;**71**:874–881.

Statistical Classification of Diseases) codes which we used to calculate Charlson comorbidity scores, another proxy for health status. Through the Danish Civil Registration System, patients' gender, age, completed educational degrees and annual income were added. PCPs and their clinics were identified through the 'Provider Register' (*Yderregisteret*). All the data were provided by Statistics Denmark and Statens Serum Institut.

We also examined the guidelines set by the Danish IRP for the drug classes studied. This information was found at http://www.irf.dk and through correspondence with the Danish Regions.

Observations

For each drug class, we defined each patient's first prescription in the 2004–2012 period as 'initial' if that patient had no prescriptions from 1 January 2000 to 31 December 2003. Since non-PCP prescribers could not be linked to the prescriptions they received, we excluded all initial prescriptions written by non-PCP physicians (n=683 288) as well as prescriptions for non-PCP patients with medical degrees (n=3658), although our results do not change if we include these observations. Our final sample contained 2 334 590 treatment initiations by non-physician patients and 3088 treatment initiations by PCPs in five drug classes (statins, n=455 586; CCBs, n=330 369; SN/SSRIs, n=423 740; PPIs, n=671 695; and antihistamines, n=456 018).

We distinguished between drugs that must be taken consistently for at least several weeks, which we call 'chronic' (statins, CCBs and SN/SSRIs), and drugs that can be used for shorter periods, including treatment of symptoms on demand, which we call 'non-chronic' (PPIs and antihistamines). Since PPIs are also used chronically for some indications[9] and SN/SSRI courses might be relatively short term, we also examined results for each drug class separately. The full list of drugs is shown in table A3 of the online supplementary appendix.

Outcome measure

We created a binary variable indicating the single-source (which we refer to as 'brand') or multisource (which we call 'generic') status of the drug first purchased by each patient. A single-source drug, by definition, is only sold by the company owning the patent. After patent protection ends, other manufacturers may begin to produce it, at which point it becomes 'multi-source.' For the 15 drugs in our sample that faced patent expiration during the 2004–2012 time period, we assigned multisource status once sales of generic entrants were observed in our data set. We focus on the choice of single-source versus multisource drug (eg, rosuvastatin vs simvastatin) because it is driven by the prescriber and determines patients' access to a low-cost generic: Pharmacists are required to offer patients the lowest cost formulation of multisource drugs. If they opt instead to purchase the brand-name version, patients must pay the entire price difference OOP. We also run a similar analysis using the outcome 'original brand formulation purchased.'

Statistical analysis

To estimate the effect of being a PCP on the relative risk (RR) of starting treatment with a brand-name drug, we estimated multivariate logistic models in which the dependent variable was whether the initial prescription was for a single-source drug and the independent variable was 1 for PCP patients and 0 for non-physicians. ORs are obtained from logistic models, but ORs have been shown to be a poor proxy of the RR of an event occurring in the treatment versus the control group when the incidence is frequent (>10%), which is the case in our setting.[10 11] Hence, we corrected the ORs by the modified Diaz-Quijano method as suggested by Dwivedi *et al*[11] in order to give the estimates a RR interpretation.

The adjusted models included patient age, gender, highest completed educational degree, a quadratic of patient's annual income in 2012 Danish kroner (US$1≈DKK 5.6), Charlson comorbidity index, patient's coinsurance rate, patient's coinsurance rate interacted with income and number of other medications used. The annual sliding scale subsidy system starts with a deductible (100% coinsurance) of DKK 890 (in 2012). The coinsurance rate then decreases (50%, 25%, 15%) as the sum of OOP spending passes various thresholds until the OOP maximum of DKK 3665 (in 2012). For the remainder of the year, prescriptions are fully covered (0% coinsurance).

The RR was estimated separately for chronic and non-chronic drug classes and for each drug class. All models included fixed effects for year by drug class and clustered standard errors by clinic.

To check whether physicians mistrust generic formulations, we estimated the same model with drug-year fixed effects and the dependent variable being whether the prescription was filled with the original brand-name version of a multisource drug.

We also conducted three sensitivity analyses. First, to address the possibility that PCP patients could have different prescribing habits than other PCPs (who did not start statin prescriptions), we estimated the model on the subsample of self-prescribing solo-practice PCPs. Since the data did not specify which physician in a joint practice wrote each prescription, we do not know if physicians with prescriptions from their own clinic wrote their own prescriptions, within joint practices. Within solo practices, however, clinic fixed effects allowed us to directly compare PCPs' self-prescriptions to the ones they wrote for their patients.

Second, we estimated our model on the subsample of patients who faced coinsurance rates of 25% or less, based on their accumulated annual OOP spending. In this subsample, patients had less of a cost-saving motivation to choose generic drugs. Limiting the sample to the subset with 0% coinsurance rates was not feasible due to the extremely small size of this subset (n=11 158 and n=15 992 for chronic and non-chronic, respectively) and insufficient overlap between the remaining physicians and non-physicians in their observable characteristics.

Third, to complement our main empirical approach of multivariate logistic regression, we use a nearest-neighbour matching approach to compare prescriptions across matched pairs of physicians and patients who look most similar to physicians on their observable characteristics. This approach is non-parametric, allowing us to avoid the use of functional forms in constructing the counterfactual for each physician in the sample. Also, comparing the means of observable characteristics between physicians and their matched non-physicians allows us to assess whether balance on observables is possible, and limiting our analysis to the matched pairs excludes completely those non-physicians who are very different from physicians.

Stata V.13 (Stata Corp) was used for all statistical analyses.

RESULTS

Our sample contained 2 334 590 treatment initiations by non-physician patients and 3088 treatment initiations by PCPs. The PCPs were slightly older, more likely to be male and had fewer comorbidities than the non-physicians (table 1). Their average annual income (DKK1 039 100) was equivalent to approximately US$177 000, comparable to US PCP earnings.[12] As expected, non-physicians had lower average income and

Table 1 Sample characteristics

	Age	Male	Charlson comorbidity index	Income	Master's degree or higher
Primary care physicians	54.85	68%	0.11	1039.10	100%
n=3088	(8.34)	(47%)	(0.55)	(644.22)	–
Non-physicians	53.44	43%	0.20	259.73	4%
n=2 334 590	(18.96)	(51%)	(0.73)	(730.25)	(19%)

SD shown in parentheses. Income is measured in 1000 DKK and converted to 2012 equivalent. All differences are statistically significant at the 1% level. Charlson comorbidity index is the mean score of the index.

less education, underscoring the importance of socioeconomic controls. In our sample, brand-name drugs were priced 4–11 times higher than generic drugs (see A2 in online supplementary appendix), and other studies link patients' income to cost-sensitivity in prescribing.[8 13]

Consistent with our grouping of statins, CCBs and SN/SSRIs as chronic drugs, the majority of initiating patients in these classes made subsequent fills (86%, 84% and 76%, respectively), while the shares of patients with more than one PPI or antihistamine fill were 45% and 26%, respectively.

Overall, 21% of initial prescriptions were for single-source brand-name drugs, but this share varied across classes (2% for statins, 4% for CCBs, 19% for SN/SSRIs, 31% for PPIs and 41% for antihistamines). The relatively high rate of brand drug prescribing in the antihistamine class is likely because multisource antihistamines were also available over the counter (OTC), but prescriptions were required for single-source desloratadine and high-strength fexofenadine. For PPIs, the brand prescribing share dropped from 97% in 2004 to approximately 0% in 2010 as several drugs became multisource due to patent expirations and some gained approval to be sold OTC.

For chronic drugs, the unadjusted risk ratio that PCPs started treatment with a single-source brand-name drug, compared with non-physicians, was 3.86 (95% CI 3.33 to 4.47; p<0.001) (figure 1). This decreased to 2.51 (95% CI 2.16 to 2.92; p<0.001) with adjustment. For non-chronic drugs, the RR for PCPs to start on a single-source branded drug was slightly higher (RR 1.13 (95% CI 1.08 to 1.20; p<0.001)). However, this difference was driven by income and disappeared with adjustment (RR=0.98, 95% CI 0.93 to 1.04; p=0.745).

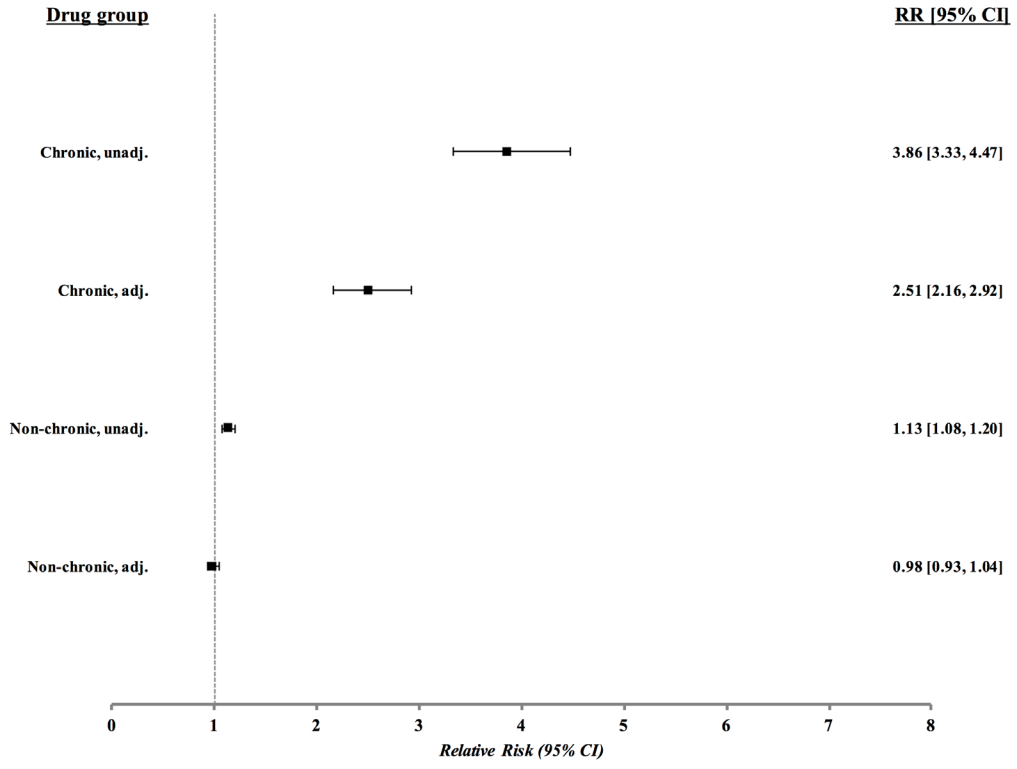

Figure 1 RR of starting treatment with a brand drug for physicians versus non-physicians, unadjusted and adjusted. Chronic drugs: statins, CCBs and SSN/RIs. Non-chronic drugs: PPIs and antihistamines. For each drug class we include the following ATCs: statins (C10AA-01,-02,-03,-04,-05,-07; C10BA02), PPIs (A02BC-01,-02,-03,-04,-05), antihistamines (R06AE-03,-05,-06,-07,-09; R06AX-02,-12,-13,-18,-22,-25,-26,-27), CCB (C08 CA-01,-02,-03,-05,-06,-08,-09,-13; C08DA51, C08DB01), SN/SSRIs (N06AB-03,-04,-05,-06,-08,-10; N06AX16,-21). RRs are estimated in a logistic model with year and drug class effects included. Characteristics adjusted are age, gender, Charlson comorbidity score, education level, coinsurance, income, interaction of income and coinsurance, and number of other drug classes used. Error bars are 95% CI. ATC, anatomical therapeutic chemical classification system; CCB, calcium channel blocker; PPI, proton pump inhibitor; RR, relative risk; SN/SSRI, serotonin-norepinephrine/selective serotonin reuptake inhibitor.

Table 2 PCP relative risk of starting on brand drug for physicians versus non-physicians, by drug class

	Unadjusted			Adjusted			Sample characteristics			
	RR			RR						
	RR	95% CI	p Value	RR	95% CI	p Value	Outcome mean	>1 Fill first year	Number of PCPs	Observations
Chronic										
Statins	11.23***	9.42 to 13.41	<0.001	5.81***	4.70 to 7.18	<0.001	0.02	0.86	706	455 586
CCB	2.42***	1.60 to 3.67	<0.001	2.15***	1.37 to 3.35	0.001	0.04	0.82	346	330 369
SSN/RI	2.04***	1.77 to 2.35	<0.001	1.26***	1.09 to 1.46	0.002	0.17	0.76	341	423 740
Non-chronic										
PPI	1.04	0.96 to 1.11	0.345	0.93*	0.87 to 1.00	0.052	0.31	0.45	1002	671 695
Antihistamines	1.28***	1.15 to 1.33	<0.001	1.04	0.96 to 1.12	0.373	0.41	0.26	697	456 018

C08DA51, C08DB01, SSN/RIs (N06AB-03,-04,-05,-06,-08,-10; C10BA02), PPIs (A02BC-01,-02,-03,-04,-05), antihistamines (R06AE-03,-05,-06,-07,-09; N06AX16,-21).
Based on the baseline mean for non-physicians and the estimated risk ratio of PCP patients, our models predict that if they had similar observable characteristics as non-physicians, PCPs would have brand drug prescribing rates of 9.9% (vs 1.7%) for statins, 8.6% (vs 4.0%) for CCBs, 21.5% (vs 17%) for SSN/RIs, 28.8% (vs 31%) for PPIs and 42.5% (vs 41%) for antihistamines. Robust standard errors in parentheses.
Adjusted models include: age, gender, Charlson comorbidity score, education level, coinsurance, income, interaction of income and coinsurance, and number of other drug classes used. For each drug class we include the following ATCs: statins (C10AA-01,-02,-03,-04,-05,-07; R06AX-02,-12,-13,-18,-22,-25,-26,-27), CCB (C08CA-01,-02,-03,-05,-06,-08,-09,-13).
***p<0.01; *p<0.1.
ATC, anatomical therapeutic chemical; CCB, calcium channel blocker; PCP, primary care physician; PPI, proton pump inhibitor; RR, relative risk; SSN/RI, serotonin-norepinephrine/selective serotonin reuptake inhibitors.

In all three chronic drug classes individually, PCPs had higher risk for starting on a brand-name drug than non-physicians (table 2). The adjusted RR was highest for statins: 5.81 (95% CI 4.70 to 7.18; p<0.001) followed by CCBs: 2.15 (95% CI 1.37 to 3.35; p=0.001) and SN/SSRIs: 1.26 (95% CI 1.09 to 1.46; p=0.002). For statins and SN/SSRIs, the RR was significantly smaller with adjustment, because income and education were positively associated with the use of brand-name drugs without generic status.

For antihistamines, an unadjusted RR of 1.28 became insignificant after adjustment: 1.04 (95% CI 0.96 to 1.12; p=0.373). For PPIs, the unadjusted RR was indistinguishable from 1 (p=0.345) and the adjusted RR was 0.93 (95% CI 0.87 to 1.00; p=0.052).

To assess whether physicians distrust generic formulations per se, we also tested if they had higher risk of choosing the original brand version of multisource drugs; see figure 2. The unadjusted RR was 1.80 (95% CI 1.30 to 2.51; p=0.002) for chronic drugs and 0.98 (95% CI 0.77 to 1.25; p=0.47) for non-chronic drugs. However, adjusting for covariates the RR for chronic drugs was 0.91 (95% CI 0.65 to 1.27; p=0.570) and 0.93 (95% CI 0.73 to 1.20; p=0.594) for non-chronic drugs, implying that once generic equivalents of a drug are available, physicians and non-physicians choose the brand name at the same rate.

Sensitivity analyses

The results of our three sensitivity analyses are shown in table 3 and in online supplementary appendix table A1. First, the results did not change with the addition of clinic fixed effects in the subsample of self-prescribing solo-practice PCPs (RR for chronic drugs 2.17; 95% CI 1.63 to 2.83; p<0.001) (table 3). Second, the results were also similar for the subsample with low coinsurance rates (RR for chronic drugs 2.87; 95% CI 2.36 to 3.48; p<0.001).

Third, as shown in online supplementary appendix table A1, the nearest neighbour matching process identified a set of non-physicians who match physicians closely on all observed characteristics and started treatment within the same drug class in the same year: using a t-test, we were not able to reject the null hypothesis of mean equality for any characteristic. Consistent with the results of our main adjusted specification, the rates of single-source non-chronic brand drug use were not different between physicians and matched non-physicians (41% vs 43%, p=0.487), while the rates of single-source chronic drug use were significantly higher among physicians (9% vs 18%, p<0.001). These results show that functional form assumptions made in our main specification are not driving our results.

The Danish health insurance system's guidelines and restrictions

IRP guidelines were available on the web,[14] with changes communicated through the *Journal of the Danish Medical Association (JDMA)*, a journal sent to all Danish physicians. In each of the chronic drug classes, local health authorities recommended a specific drug as the first-line treatment, based on IRP guidelines: simvastatin among statins, amlodipine for CCBs treating hypertension, and citalopram or sertraline among SSRIs, with SNRIs recommended only when SSRI treatment fails. In 2007 and 2009, respectively, the Danish Reimbursement Committee made prior use of simvastatin or amlodipine a prerequisite (step therapy) for any brand statin or CCB to receive the usual government subsidy. However, these restrictions could be over-ridden by the doctor writing 'subsidy,' and we do not find that they had any impact on prescribing beyond the guidelines themselves.

For antihistamines, non-sedating antihistamines were recommended and considered equal. For PPIs, the IRP called all drugs 'therapeutically equivalent' and recommended prescribing the cheapest. In 2011, the remaining single-source PPIs, rabeprazole and esomeprazole, lost coverage under the government insurance system. Unlike in the USA, drug prices are uniform across pharmacies and easily accessible on the web. All coverage restrictions were communicated through *JDMA* and online.

DISCUSSION

Our finding that physicians start on single-source brand-name chronic drugs more frequently than non-physicians implies that[1] at least some physicians view more recently released drugs as clinically superior and[2] they are more likely to ignore the guidelines to start with older, generic drugs when treating themselves versus other patients. The absence of a similar finding in the non-chronic drug classes could be related to the fact that all PPIs and antihistamines were described as 'therapeutically equivalent' by regulators. In the chronic drug classes, the recommendation of a specific generic agent, rather than a blanket guideline to choose the lowest cost generic agent, could be seen to suggest that one generic drug is therapeutically preferable to the others, possibly leading to the inference that quality differences exist within the drug class.

Clinical evidence for therapeutic differences could explain why the largest divergence in PCPs and non-physicians' treatment was in the statin drug class. Different statins have predictably different effects on low-density lipoprotein (LDL), making some drugs more suitable for patients who need larger reductions in their LDL levels. While we could not observe patients' LDL, it is unlikely that physicians' levels were higher than those of non-physicians, since PCPs had lower Charlson comorbidity scores and physicians tend to have healthier lifestyles.[15 16] Nevertheless, Danish physicians were 15.6 times more likely to start statin treatment with rosuvastatin, and 4.8 times more likely to start with atorvastatin than the average Danish patient, suggesting physicians might prescribe more potent statins to other patients in the absence of the guidelines.

By contrast, no clinically meaningful differences in the efficacy of PPIs have been established,[17 18] and this was the only class in which PCPs appeared possibly less likely to use brand-name drugs than comparable non-physicians. For SN/SSRIs, the various drugs have similar first-line efficacy[19] but vary in their side effects.[20 21] For CCBs, evidence of therapeutic equivalence or differences is lacking. Among second-generation antihistamines, cetirizine (multisource over most of this period) may be more effective in treating allergic rhinitis, but might also cause more drowsiness.[22 23 24]

Our finding that higher income and education are positively associated with using newer (on-patent) brand-name drugs is consistent with prior research.[13] If there is some known or perceived quality benefit associated with more recently released drugs, as in the case of statins, it is likely that patients of higher socioeconomic status would be both more aware of these differences and have a higher willingness to pay for marginal benefits.

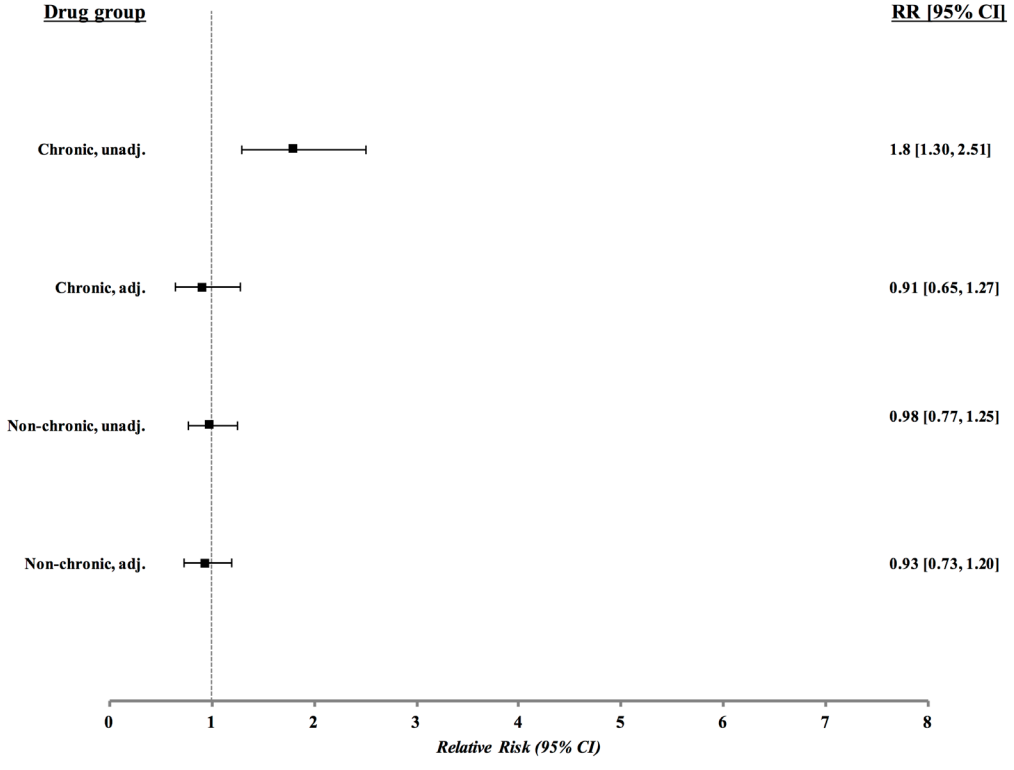

Figure 2 RR of starting treatment with the brand version of a multisource drug for physicians versus non-physicians, unadjusted and adjusted. Chronic drugs: statins, CCBs and SSN/RIs. Non-chronic drugs: PPIs and antihistamines. RRs are estimated in a logistic model with year and drug class effects included. Characteristics adjusted are age, gender, Charlson comorbidity score, education level, coinsurance, income, interaction of income and coinsurance, and number of other drug classes used. Error bars are 95% CI. CCB, calcium channel blocker; PPI, proton pump inhibitor; SSN/RI, serotonin-norepinephrine/selective serotonin reuptake inhibitors; RR, relative risk.

Table 3 Sensitivity analyses

PCP (0/1)	Chronic drugs			Non-chronic drugs			Outcome mean	Number of PCPs	Observations
	Adjusted RR			Adjusted RR			(Chronic/non-chronic)		
	RR	95% CI	p Value	RR	95% CI	p Value			
Self-prescribing PCPs in solo practices, prescriber fixed effect included	2.17***	1.63 to 2.83	<0.001	0.98	0.88 to 1.09	0.688	0.07/0.37	481/496	62 080/79 205
Subsample with low coinsurance rates (0%–25% paid out of pocket)	2.87***	2.36 to 3.48	<0.001	0.92**	0.84 to 0.99	0.035	0.08/0.39	398/457	358 860/277 915

C08DA51, C08DB01, SSN/RIs (N06AB-03,-04,-05,-06,-08,-10; C10BA02), PPIs (A02BC-01,-02,-03,-04,-05), antihistamines (R06AE-03,-05,-06,-07,-09; N06AX16,-21).
Chronic drugs include statins, CCBs and SSN/RIs. Non-chronic drugs include PPIs and antihistamines. All models include year-by-class dummies. Adjusted models include: age, gender, Charlson comorbidity score, education level, coinsurance, income, interaction of income and coinsurance, and number of other drug classes used. For each drug class we include the following ATCs: statins (C10AA-01,-02,-03,-04,-05,-07; R06AX-02,-12,-13,-18,-22,-25,-26,-27), CCB (C08CA-01,-02,-03,-05,-06,-08,-09,-13).
***p<0.01; **p<0.05; *p<0.1.
CCB, calcium channel blocker; PCP, primary care physician; PPI, proton pump inhibitor; SSN/RI, serotonin-norepinephrine/selective serotonin reuptake inhibitors; ATC, anatomical therapeutic chemical; RR, relative risk.

Following the presumption that physicians have greater medical knowledge than the public, other studies have examined the health behaviour of physicians as a benchmark for fully informed choices.[15 25 26] Physicians have fewer C-sections,[26 27] obtain fewer unnecessary antibiotics for their children[28] and prefer less intensive end-of-life care than non-physician patients receive.[29] It is striking that in all these studies, doctors opt for less intensive and less costly treatment, with a larger difference when providers face greater financial incentives for overtreatment.[27] This suggests that patients with more medical knowledge are less susceptible to provider-induced demand.[27] In our setting, by contrast, physicians face no financial incentives to prescribe specific drugs, but rather, pervasive soft encouragement to prescribe low-cost drugs. Thus, our finding that physicians opt for more expensive drugs than non-physicians reflects the other side of the same coin: both financial incentives and cost-saving guidelines can sway providers away from their preferred treatment choices, as defined by how they themselves would like to be treated.

Our study builds on prior work by Liou *et al*[30] examining the oral hypoglycaemics used by diabetic healthcare professionals, including 48 physicians, at one Taiwanese hospital. Consistent with our results, they found that health professionals were more likely to choose brand-name drugs than the general population, but they could not adjust for income or education level. Also, Bronnenberg *et al*[31] found that physicians were slightly less likely to purchase brand-name OTC drugs with generic substitutes than the general population, consistent with our finding that physicians do not distrust generic drugs per se. We find that although physicians are more likely to start treatment with new, on-patent brand drugs than non-physicians, they are just as likely to fill prescriptions with generic formulations of a drug after its patent expiration, suggesting that physicians are not poorly informed or overly sceptical about the quality of generic medications. There are still several reasons why physicians might favour newer, on-patent brand drugs, including the influence of pharmaceutical marketing, attention bias to recently published studies about new drugs and true differences in efficacy that physicians might value more than the average patient.

Overall, physicians prescribed brand-name chronic drugs at modest rates, largely adhering to IRP guidelines. This is somewhat surprising since there was no monitoring of their prescribing nor incentives for following guidelines.[32] Physicians' contract with the Danish state, however, nominally requires them to 'assist their region in ensuring economically responsible use of reimbursable pharmaceuticals.'[32] Accordingly, Danish physicians are more likely than physicians in other OECD (Organisation for Economic Co-operation and Development) countries to prescribe low-cost antihypertensives[33] and to follow guidelines for antibiotic prescribing.[34]

Finally, it is important to note that the RR ratio between physicians and non-physicians was largest in the drug classes with the smallest baseline rates of brand drug use (statins and CCBs). Based on the rates of brand drug use and the adjusted RR of physicians, we can infer that if physicians had similar demographics as non-physicians, their rates of brand statin use would be almost eight percentage points higher (9.87% vs 2%) while their rates of using brand CCBs and serotonin-norepinephrine/selective serotonin reuptake inhibitors (SSN/RIs) would both be approximately four to five percentage points higher. Thus, it is possible that only a minority of physicians (less than 10%) are responsible for the effects we describe in this paper, while the majority agree with the prescribing guidelines and/or treat

themselves no differently than their patients. Future work could explore how these physicians differ from others.

LIMITATIONS

Our results should be interpreted in the context of several limitations. Around one-third of the Danish population buys supplemental private insurance that reduces OOP costs for prescription drugs and other services, but we cannot observe this. A possible concern is that physicians were more likely to have secondary coverage and therefore faced less added cost for brand-name drugs. This would only bias our results if physicians were more likely to purchase supplemental insurance than other highly educated high earners. Moreover, we would expect the bias to be significantly reduced in the sensitivity check comparing PCPs and non-physicians with generous subsidy rates (0%–25% coinsurance), since the influence of secondary coverage on their costs would be muted. Importantly, our results remain consistent in this subsample.

Another limitation is our inability to observe OTC drug purchases, which would give a fuller picture of the usage of PPIs and antihistamines. In the classes where we observe all purchases, however, physicians clearly use more brand-name drugs. We are also unable to obtain the indication for each prescription, which could bias our results if, for example, physicians are more likely than non-physicians to use CCBs for hypertension as opposed to heart failure. However, our results are strongest for statin drugs, which are used exclusively to treat hyperlipidaemia, and do not change when we use data on past hospitalisations for cardiac events to control for the use of statins for primary versus secondary prevention (results not shown).

Lastly, the generalisability of our results outside of Denmark is unknown. In the USA, where both physicians and non-physicians are exposed to pharmaceutical advertising, physicians' relative rates of brand drug use may be different. The Danish national healthcare system, however, offered the unique ability to compare PCPs with the broader population while controlling for their socioeconomic differences, and to identify first-time prescriptions more accurately than commercial claims data allow.

What is already known on this subject?

Physicians have fewer C-sections, obtain fewer unnecessary antibiotics for their children and prefer less intensive end-of-life care than non-physician patients.

Prior work suggests that physicians have preferences for brand-name drugs when they are patients themselves, but it is unclear if this is driven by health differences/socioeconomic status.

What this study adds?

Physicians are more likely to prescribe newer brand drugs to themselves than to their patients in three chronic drug classes after controlling socioeconomic characteristics and health status.

Physicians tend to adhere less to guidelines when treating themselves.

Policy implications

This study provides evidence that guidelines and step therapy may violate physicians' clinical judgement.

Guidelines and step therapy may induce undertreatment in some patients.

CONCLUSION

Studying physicians' personal use of prescription drugs can provide insight on their perceptions of comparative efficacy. In three chronic drug classes in which first-line treatment with a generic drug is encouraged, PCPs are more likely to prescribe newer brand drugs (drugs without generic equivalents) to themselves than to their patients. This is particularly evident in the case of statins, likely due to their well-known variation in potency. Physicians are not more likely, however, to opt for brand-name versions of multisource drugs, suggesting they do not mistrust generic formulations. Further work is needed to understand whether differences in clinical evidence, expected duration of treatment or the symptomatic/asymptomatic nature of conditions under treatment explains why physicians are more likely to start with branded statins, CCBs and SN/SSRIs, but not brand-name PPIs or antihistamines.

Future work should also explore the characteristics of physicians who are more likely to receive different drugs than their patients, and whether this predicts differential treatment in other contexts. In the drug classes that we studied in this paper, clinical consequences of differential brand drug use are likely to be minor, given the broadly similar efficacy and safety profiles of drugs within each class. But in other contexts, the implications of differential treatment might be more concerning.

Correction notice This paper has been amended since it was published Online First. Owing to a scripting error, some of the publisher names in the references were replaced with 'BMJ Publishing Group'. This only affected the full text version, not the PDF. We have since corrected these errors and the correct publishers have been inserted into the references.

Acknowledgements The authors would like to thank Esben Agerbo, Glen Taksler, Mark Votruba, William Feldman and the reviewers for helpful comments and suggestions.

Contributors MC and NS contributed equally in the conception and design of the work, interpretation of the analysis, drafting the article, critical revision of the article and final approval of the version to be published. NS had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Competing interests None declared.

Ethics approval Danish Data Protection Agency.

Provenance and peer review Not commissioned; externally peer reviewed.

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J Epidemiol Community Health 2017 71: 874-881 originally published online July 3, 2017
doi: 10.1136/jech-2016-208837