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Influencing physician prescribing in an international context

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Document Version

Publisher's PDF, also known as Version of record

Publication date:

2007

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Sturm, H. B. (2007). *Influencing physician prescribing in an international context: the role of systems, policies, and patients*. s.n.

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How does the strength of primary care influence heart failure prescribing in Europe?

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Abstract

Aims: To assess the role of primary care related health care system characteristics in international variation of chronic heart failure (CHF) prescribing, aside from the role of patient characteristics.

Methods: : Prescribing data from the IMRPOVEMENT- HF survey including 8605 CHF patients from 100 primary care practices in 11 different countries was analyzed. The influence of health system characteristics was analyzed with multilevel regression analysis.

Results Prescribing of guideline-recommended prescribing ranged from 53% in Sweden to 76% in Hungary. Our models almost entirely explained variation on the country level. Stronger primary care orientation made adherent prescribing less likely. Of individual primary care related factors, gatekeeping decreased and physician density increased adherent prescribing. Higher healthcare expenditure, salaried or capitated remuneration also impaired quality.

Conclusion: Our analysis almost entirely explained variation on the country level. Overall primary care orientation along with factors limiting access and volume of care had an unfavorable effect on prescribing quality for heart failure, while factors facilitating higher treatment intensity improved it. This suggests a relation between prescribing quality and access to care such as specialist involvement. Interdisciplinary approaches therefore could enhance beneficial effects of comprehensive primary care.

Keywords: Heart failure, primary care, quality of care, Europe, international studies

Introduction

Since national guideline recommendations for heart failure are similar¹ the growing evidence about international variation in prescribing indicates potential quality problems². This issue is of concern for clinicians and other care providers, but also of for policy makers, who are looking at other countries in the search for efficient care structures. Therefore understanding the underlying reasons for such variation is relevant for all stakeholders in health care, clinicians and policy-makers alike. This is particularly the case in increasingly prevalent cardiovascular diseases such as chronic heart failure (CHF), where treatment costs already consume between 1-2% of national health care resources^{3,4}.

Drugs form the most important part of CHF treatment and therapeutic options have been significantly improved in recent years. These innovations mostly resulted in additions of newer drugs rather than replacements of older drugs, contributing to the complexity of therapy. Currently, a heart failure patient should always receive an ACE-inhibitor as first line drug. Beta-blockers should as well be considered in all symptomatic patients. In severe heart failure, additionally aldosterone antagonists are recommended. Alternatively or in addition, there are glycosides and the newer angiotensin-II antagonists and selective RAAS inhibitors. Patients will also usually be treated with diuretics, and frequently with anti-arrhythmics and anti-thrombotic agents⁵.

Various studies and trials^{2,6,7,8} have described international variation in CHF drug therapy, for hospitalized patients⁶ and primary care⁷ alike. In primary care, where CHF patients in Europe are mainly treated, prescribing for ACE-inhibitors ranged from 48-76%⁷.

Explanations for disparity in treatment focused mostly on hurdles concerning the implementation of new evidence on the physician level⁹ or on patient characteristics and concomitant diseases^{7,10}. In addition however, a clear additional influence of the patient's country on CHF prescribing in European primary care has been demonstrated¹¹ pointing to an additional impact of care structures or culture. Yet it is unclear, which specific features within national health care systems and in particular within primary care, influence therapeutic decision-making.

Using comparative data with the possibility to account for factors on all levels (patients, physicians, countries), this study aims to assess the influence of primary care-related health system characteristics on prescribing for CHF in Europe.

Methods

Study design:

This is a cross-sectional study with a multi-level design.

Outcome: quality of heart-failure prescribing

Prescribing quality was measured with the frequency of ACE-inhibitor or AII antagonist. This is a commonly used performance indicator for CHF therapy¹².

Its solid evidence base is reflected since years in major national and international guideline recommendations¹³.

Determinants

To test the impact of primary care characteristics on CHF prescribing relevant health care characteristics were selected on a theoretical basis supported by evidence from literature.

Two approaches were used: firstly the impact of overall primary care (PC) orientation was assessed using an aggregate score (PC-score). Secondly, individual factors relevant for primary care were used as determinants.

As aggregate measure a validated score based on Starfield and Macinko was applied^{14,15}, which covers ten aspects of primary care related to structure and practice: method of national health care financing, regulation of practice location to account for resource distribution, training of primary care physicians, access to care (patient cost-sharing), and gatekeeping and patient lists reflecting continuity of care over time. Practice aspects are assessed by the comprehensiveness of care provided by PCPs, family centeredness, community orientation and information processing between primary and secondary care.

In the second approach the aggregate score was replaced by the following individual determinants, which were significant determinants of prescribing in univariate analysis: physician density (as a proxy for access to care and workload, conceptually related to regulation of practice location of the PC-score), gatekeeping and the level of patient cost-sharing of care (measured as out-of-pocket expenditure in % of total HC expenditure).

In addition to primary care characteristics, we adjusted for the national level of health care (HC)-expenditure, the remuneration of physicians and the accessibility to echocardiography. HC-expenditure (which is strongly related to GDP¹⁶) reflects the “input” into a nation’s health care system. Theoretically higher expenditure could facilitate better care. We used HC-expenditure excluding drug expenditure, since drug expenditure is directly linked to prescribing and is strongly dependent on national drug price levels. Time necessary to obtain an echocardiography is reflecting the degree of diagnostic security which is considered an important factor for CHF prescribing¹⁷. Physician remuneration on prescribing is considered an important determinant of practice patterns in cardiology, although evidence on effects is unclear¹⁸.

At the patient level, the following characteristics were adjusted for (significant predictors of prescribing in earlier multivariate analysis, including country¹⁹): age and sex, severity of disease (according to NYHA-classes), availability of an abnormal echocardiogram, as well as history of myocardial infarction or stroke, atrial fibrillation, hypertension, diabetes, lung disease, peripheral artery disease and renal dysfunction.

Data collection

Prescribing data was derived from the Improvement-HF survey from 1999/2000, including 11064 patients from about 100 primary care practices in 14 European countries¹. Data collection and main results have been described in detail elsewhere⁷. Each country was divided in 10 regional centers, urban and rural. Participating physicians were randomly selected accordingly. Patients seeing their primary care physician with a diagnosis of CHF and/or myocardial infarction were included over a six-week period in 1999. Information about patient characteristics such as age, gender, co-morbidities and diagnostic procedures was abstracted from patient charts.

The PC- scores of most countries were available from Macinko¹⁵. Additional scores were calculated based on literature and confirmed by national experts. Due to missing information and lack of expert opinion, Poland, Russia, Turkey were excluded from analysis, leaving 11 countries for the analysis (See Tab. 1) . Scores range on a scale between 0 (low) and 20 (high) (App. 1).

¹ Countries in Improvement-HF: Belgium, Czech and Slovak Republic, France, Germany, Great Britain, Hungary, Italy, Poland, Russia, Spain, Sweden, Switzerland, The Netherlands, Turkey

Health care system data is based on OECD HIT country profiles, WHO and OECD health data from 1998/1999 (European Observatory on Health Systems and Policies) {2006 698 /id, Reinhardt, 2002 160 /id; WHO, 2006 699 /id}. Accessibility of echocardiograms is derived from the Improvement-HF survey itself (measured as % of PCPs who can obtain an echocardiogram within one week)²⁰.

Statistical analysis

Due to the data's intrinsically hierarchical nature where observations are not independent multilevel regression analysis was applied. The levels were: patients (level 1), primary care physicians (PCPs) (level 2), countries (level 3). Multilevel analysis allows to split total variance of prescribing quality and to attribute it to each individual level. To assess the proportion of the total variance at each level, intraclass correlation (ICC) was calculated. ICC of e.g. the country level is defined as the variation between countries divided by the total variation in quality of prescribing²¹.

The analysis was carried out in 3 steps. An "intercept-only model" was calculated first. This model without any determinant establishes each level's contribution to variation. Next, patient characteristics were added, and thirdly country level variables. Besides the overall physician level, no individual physician variables were included. The contribution of each determinant in the multivariate analysis was expressed as OR and 95% confidence interval (CI). MLwiN software, version 2.0 was used. The logistic regression models were estimated using PQL with second order approximation and with extra-binomial variance.

Table1: country characteristics, health care indicators

	total	Belg	Czech	France	Germ	Hung	I	NL	Spain	Swe	Switz	UK
Total patient (n):	8605	621	849	1227	873	861	778	769	705	663	660	599
Outcome variable												
ACE or ACII (n)	5630	455	540	810	594	655	589	461	379	352	414	381
(%)	65,43	73,27	63,60	66,1	68,04	76,07	75,71	59,95	53,76	53,09	62,73	63,61
Unit / scale												
Determinants												
Primary care Score [20]	0-20	4	6	2	3	10	14	17	16,5	11	2,5	19
gatekeeping [20] (1995/1998)		0	0	0	0	1	2	2	2	0	0	2
Physician density (2)		3,95	3,08	3,27	3,20	3,16	5,90	3,10	2,99	2,87	3,35	1,60
							physicians / 1000 patients					
out-of pocket payments (1)		24,7	33,3	8,5	10,9	10,3	10,7	18,9	16,9	24,9	23,2	29,1
							% of tot HC expenditure					
Total HC* expenditure without drug expend (1 / 2)		7,32	4,83	7,44	9,28	5,31	6,08	7,08	5,97	7,36	9,66	5,99
Physician Remuneration (3)		0	1	0	0	3	3	3	2	2	0	3
Echo obtainable within 1 week [33]		94,5	50,5	88,1	93,8	55,1	24	21,8	4,6	6,5	77,2	5,9
							% of physicians					

* data from 1999 if not noted otherwise, source: OECD (1), WHO (2), HIT country profiles and other country specific information(3). Gatekeeping: 0=free access to specialist
1=incentives to reduce direct access 2=referral required. Remuneration : 0=fee-for-service (FFS), 1 =mixed, 2=salary, 3=capitation

Results

On average, 65.4% of the patients were treated with ACE-inhibitors or All-antagonists, ranging from 53% in Sweden to 76% in Hungary (Table 1). Countries with the highest PC- scores were the UK, Spain, The Netherlands and Italy. Germany, France and Belgium show the weakest primary care orientation. None of those countries have a gatekeeping system implemented, whereas high PC-scores go along with strict gatekeeping. Out-of-pocket payments vary from 8 to over 30% of all health expenditures. Except for Hungary, in countries with weak PC-scores, PC physicians are paid with fee-for-service (FFS) arrangements. These countries also tend to have better access to diagnostics, measured in Echocardiogram-accessibility.

Relevance of health care system:

Random effects showed, that variation on the country-level contributed significantly to the model although most variation was explained by patient characteristics and also partly by physician level. When adding the patient level, intra-class variation of country remained significant, but decreased to zero when country-level variables were added, indicating that these variables were able to explain the remaining variation on country level.

Table 2: effects on ACE-inhibitors or ARBs prescribing

	Model i (empty model)		Model including patient level		Model including patient and country level (with PC score)		Model including patient and country level (with individual PC factors)	
<i>Random effects</i>	ICC (%)	Variance (SE)	ICC (%)	Variance (SE)	ICC (%)	Variance (SE)	ICC (%)	Variance (SE)
Country level (n=11)	3,26	0,121 (0,055)	1,83	0,068 (0,033)	0,23	0,008 (0,008)	0	0
Physician level (n=1057)	8,00	0,297 (0,038)	9,11	0,337 (0,042)	9,25	0,336 (0,042)	9,00	0,326 (0,041)
Patient level (n=8464)	88,7	0,948 (0,016)	89,1	0,942 (0,015)	90,5	0,942 (0,015)	91,0	0,943 (0,015)
<i>Fixed effects</i>								
Determinants			OR	95% CI	OR	95% CI	OR	95% CI
Primary care factors								
Primary care (PC) score					0,932	(0,88-0,98)		
Gatekeeping (strong)							0,657	(0,53-0,82)
Physician density							1,114	(1,04-1,20)
Out-of pocket payments							0,990	(0,97-1,01)
HC system factors								
HC expend					0,937	(0,85-1,04)	0,849	(0,77-0,94)
Remuneration FFS* (mixed)					0,534	(0,26-1,04)	1,413	(0,69-2,91)
Remuneration FFS (salaried)					0,323	(0,20-0,51)	0,402	(0,28-0,58)
Remuneration FFS (capitation)					0,520	(0,36-0,74)	0,410	(0,28-0,61)
ECHO within 1 week					0,995	(0,98-1,01)	0,987	(0,97-1,00)
Patient characteristics:								
Age (year)			0,999	(0,99-1,00)	0,999	(0,99-1,00)	0,998	(0,99-1,00)
Sex (m)			0,922	(0,83-1,02)	0,925	(0,84-1,03)	0,921	(0,83-1,02)
Severity (NYHA 3/4)			1,413	(1,26-1,58)	1,408	(1,26-1,57)	1,406	(1,26-1,57)
Echo (abnormal)			1,866	(1,67-2,08)	1,866	(1,67-2,08)	1,868	(1,67-2,08)
MI			0,977	(0,88-1,09)	0,978	(0,88-1,09)	0,973	(0,88-1,08)
Stroke			0,885	(0,74-1,06)	0,888	(0,74-1,06)	0,889	(0,74-1,07)
Atrial fibrillation			1,020	(0,90-1,15)	1,018	(0,90-1,15)	1,022	(0,91-1,15)
Hypertension			1,936	(1,74-2,15)	1,931	(1,74-2,15)	1,940	(1,75-2,15)
Diabetes mellitus			1,424	(1,25-1,63)	1,424	(1,24-1,63)	1,426	(1,25-1,63)
Lung disease			0,991	(0,88-1,12)	0,993	(0,88-1,12)	0,990	(0,88-1,11)
Per. vasc. disease			1,028	(0,90-1,18)	1,029	(0,90-1,18)	1,027	(0,895-1,18)
Creatinine (abnorm)			1,032	(0,91-1,17)	1,040	(0,92-1,18)	1,031	(0,91-1,17)

Abbreviations: ICC – intraclass correlation; PC - primary care; NYHA - New York Heart Association (Score for clinical severity of heart failure with NYHA 4 being the most severe); Echo- Echocardiogram; MI - myocardial infarction; per. vasc. disease - peripheral vascular disease; HC - health care; FFS - Fee for service. * reference for remuneration: Fee for service (FFS)



Fixed effects (Determinants):

A stronger primary care orientation as measured by the PC-score decreased the likelihood of recommended prescribing. The presence of gatekeeping as one of the three individual primary care indicators showed a corresponding decrease. Physician density by contrast significantly increased the likelihood for recommended prescribing (OR: 1.11; 95% CI: 1.04-1.2). Out-of-pocket payments for patients did not influence prescribing quality.

Of the additional system characteristics only remuneration of physicians showed consistent significant influence: physicians who are reimbursed by capitation or are salaried tend to prescribe less recommended ACE-inhibitors as compared to PCP's under fee-for-service schemes. Overall HC-expenditure was only significant in the model with individual PC characteristics: higher spending (excluding pharmaceutical expenditure) decreased quality. Accessibility of echocardiography did not show an effect.

Effects of patient characteristics were consistent over all models. Severity of disease, available abnormal echocardiogram, presence of hypertension and diabetes increased prescribing quality. Also non-significant results were mostly in line with earlier analysis¹⁹ (tab 2).

Discussion

Our analysis showed, that a significant part of international variation in heart failure prescribing can be attributed to the country level. Stronger overall primary care orientation of a country decreased the likelihood of recommended prescribing, also when accounting for patient and physician characteristics. Less specialist involvement in those countries could contribute to that, as specialists have been shown to prescribe more guideline-conform²².

To get a better insight, additionally individual primary care components were tested.

The presence of gatekeeping decreased the likelihood of prescribing quality. Gatekeeping is one central component of primary care, giving the primary care physician responsibility for the coordination of all aspects of care, including specialist involvement. Therefore care under gatekeeping is expected to be more comprehensive²³, resulting in better overall health outcomes. Gatekeeping has been shown to increase efficiency²⁴, also by decreasing care provision, including (unnecessary) medication and referrals to specialists²⁵.

Not only access to specialists, but also to diagnostics may be affected by gatekeeping. Descriptively, in our data access to echocardiography seems to be worse in countries with strict gatekeeping. Echocardiography is also considered a proxy for diagnostic uncertainty, which may impact prescribing quality¹⁷. Therefore we corrected both our models for the accessibility of echocardiography, which however did not show any significant effect on prescribing quality.

That physician density significantly increased recommended prescribing is in line with our expectations. It conceptually reflects workload with too few physicians impairing quality of care²⁶. At the same time it is also linked to access: Higher physician density should facilitate easier and quicker access to care. Together with effects of gatekeeping, this could indicate that good access to physicians is central for prescribing quality in heart failure.

Physicians have been shown to adapt their prescribing in order to keep the financial burden for patients low²⁷. Therefore higher out-of-pocket payments could have decreased prescribing quality, which was not supported by our data. Since drugs for chronic diseases such as heart failure are frequently exempt, co-payments might not be relevant in this case.

The method of physician remuneration has been shown to influence care²⁸, however, evidence on cardiovascular prescribing is weak²⁹. In both our results fee-for-service (FFS) payment increased quality of prescribing as compared to fixed remuneration forms. This is in line with theories, where capitation and salary, both process independent payments, bare the risk of undertreatment, while FFS offers an incentive to intensify therapy³⁰ and has been shown to intensify physician-patient contacts³¹.

While the level of overall health care expenditure is a relevant determinant for health outcomes¹⁵, our data indicated a reverse relationship with prescribing quality.

Stronger primary care orientation has been associated with lower cardiovascular (and overall) mortality¹⁵. However prescribing was negatively influenced by strong PC-scores along with all individual factors limiting access to care. This paradoxical influence on care process and health outcomes is understandable considering the limited role of health care in decreased mortality from ischemic heart disease in many countries³². Starfield argued that comprehensiveness of care is but one component of primary care responsible for better health outcomes. The patient-centered, holistic approach of primary care physicians supposedly outweighs the

better disease-specific treatment often measured in specialists³³. This view is in line with concerns towards the expectable benefit of guideline-based drug therapy in “real life” of primary care. Typical primary care patients frequently require poly-pharmacy and long-term treatment which decrease adherence and increase potential side effects³⁴. The effects thereof often go undetected in short-term trial results.

On the other hand, evidence supporting the benefit of guideline-based recommended treatment on outcomes in cardiology is growing, also within older or multi-morbid populations as usually seen in primary care practice³⁵. Positive effects of adherent heart failure prescribing along with specialist involvement have been shown for readmission rates, quality of life and mortality (however with increased costs²²). Disease management approaches, integrating interdisciplinary care with standardized procedures, have proven effective and are increasingly implemented to deal with complex, chronic diseases such as heart failure³⁶.

Limitations of the study:

In general, health system or outcomes data are heavily depending on national data collection and availability¹⁶. Thus, although the primary care score was previously applied, it still can be discussed whether it is reflecting reality in all aspects. Also due to limited comparability we used overall physician density rather than the number of GPs. The lack of available, valid data also limited the inclusion of theoretically relevant variables such as the marketing intensity.

Effects of each determinant can never be interpreted out of the context of the underlying system. Although we tried to correct for some important characteristics, still others might be more relevant. Therefore caution is necessary in interpretation. HC settings are frequently related, which was the cause of restricting included determinants to major factors in this analysis. Still our models could almost entirely explain country variation.

Although PCP and patient inclusion followed a quasi-random procedure, the study was not intended for country system comparison but for the assessment of prescribing quality. It cannot be excluded, that participating physicians were still a selective group, not entirely representative of PCP in their country.

Summary and conclusion:

We found, that strength of overall primary care as well as individual settings limiting care provision had an unfavorable effect on prescribing quality for heart failure, while factors facilitating access and treatment intensity such as physician density and fee-for-service payment improved it. Primary care's positive effects on health outcomes together with its negative effects on prescribing quality suggest, that combining primary care with specialist involvement might achieve best outcomes. Especially for diseases requiring complex treatments such as heart failure, interdisciplinary approaches like disease management programs seem to be the way ahead.

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