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Is the physician's adherence to prescription guidelines associated with the patient's socioeconomic position? – An analysis of statin prescription in South Sweden.

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Abstract

Background: Knowledge about the social and economical determinants of prescription is relevant in health care systems like the Swedish one, which is based on the principle of equity, and which aims to allocate resources on the basis of need and not on criteria that are based on social constructs. We therefore investigated the association between patient and health care practice (HCP) characteristics on the one hand, and adherence to guidelines for statin prescription on the other, with a focus on social and economic conditions.

Methods: The study included all patients in the Skåne region of Sweden who received a statin prescription between July 2005 and December 2005; 15 581 patients in 139 privately-administered HCPs and 24 593 patients in 142 publicly-administered HCPs. Socioeconomic status was established using data from LOMAS (Longitudinal Multilevel Analysis in Skåne), and stratified multilevel regression analysis was performed.

Results: The proportion of patients receiving recommended statins was lower among privately-administered HCPs than among publicly-administered HCPs (65% vs. 80%). Among men (but not women), low income ($PR_{privateHCP}$ = 1.04 (1.01–1.09) and $PR_{publicHCP}$ = 1.02 (0.99–1.07)) and cohabitation ($PR_{privateHCP}$ = 1.04 (1.04–1.08) and $PR_{publicHCP}$ = 1.03 (1.01–1.07)) were associated with higher adherence to guidelines.

Conclusion: The physician's decision to prescribe a recommended statin is conditioned by the socioeconomic and demographic characteristics of the patient. Beyond individual characteristics, the contextual circumstances of the HCP were also associated with adherence to guidelines. An increased understanding of the connection between the patient's socioeconomic status and the decisions made by the physician might be of relevance when planning interventions aimed at promoting efficient and evidence-based prescription.

Background

Adherence to prescription guidelines is of high relevance not only for ensuring evidence-based pharmacological treatment in routine practice, but also for promoting the efficient use of a limited health care budget in the community.

This subject has therefore attracted substantial attention in many previous studies. [1-5] It is also well documented that sociological factors play a role in clinical decision-making. [6-10] Knowledge about the social and economical determinants of prescription is relevant in health care systems like the Swedish one, which is based on the principle of equity, [11] and which aims to allocate resources on the basis of need and not on criteria that are based on social constructs rather than a medical rationale. Social roles and expectations related to the gender, age, or socioeconomic position (SEP) of the patient might condition the physician's behaviour independently of needs. On the one hand, the prescription of a more expensive brand may reveal a different approach to a specific therapeutic problem that could result from differences in information and knowledge. However, it could also express the belief that more expensive drugs are better than cheaper ones, or could be used for the purpose of displaying income or wealth where this display serves as an instrument of attaining or maintaining social status. [12] Studies have shown that insurance status affect physicians' inclination to prescribe recommended drugs.[13] However, in Sweden, the cost of medicines in outpatient care is shared by patients and county councils via a reimbursement system where the individual patient never pays more than 200 Euros per year.[14] The total cost for a year of statin treatment varies from approximately 30 Euros (the cheapest recommended statins) to 600 Euros.[15] Therefore, this investigation can provide additional information about the mechanisms underlying the drug choice and prescribing behaviour.

Analogously, contextual factors related to the health care practices (HCPs) where the patients are treated might condition prescription patterns that are not necessarily based on evidence. Such practice differences in adherence to prescription guidelines might also express inefficient therapeutic traditions, especially when the brands prescribed are more expensive than the recommended ones. [2, 3, 16]

As in previous studies, we have focused here on cholesterol-lowering drugs from the class of HMG-CoA reductase inhibitors (statins), since different brands have the same indication and only marginal differences in efficacy, and there are therefore no solid reasons for justifying the prescription of more expensive non-recommended brands to patients of a certain age, gender, or SEP.[17, 18]

In the present study, we performed a multilevel analysis to investigate the association between patient and HCP characteristics on the one hand, and adherence to guidelines for statin prescription on the other, with a focus on social and economic conditions.

Material and Methods

The Skåne region is situated in the southern part of Sweden, and its population of about 1.2 million represents approximately 13% of Sweden's total population. At the time of our study, the health care system in Skåne was organized into 14 publicly administrative health care areas HCAs, which in turn managed 142 primary HCPs and hospital outpatient care clinics assisted respectively by general practitioners (GPs) or other specialists. In addition the health

care system included 132 private primary HCPs assisted by GPs or other specialists. Both privately-administered and publicly-administered HCPs were funded through taxes.

We used the record linkage LOMAS (Longitudinal Multilevel Analysis in Skåne) database that among other information includes the socioeconomic characteristics of the patients as well as data from the Swedish Prescribed Drug Register. This last register records information on sales of prescribed pharmaceutical agents dispensed by the Swedish Corporation of Pharmacies, we selected all patients registered in Skåne who received a statin prescription issued by a physician from one of the region's public or private HCPs between July 2005 and December 2005. The 142 public HCPs yielded 24 119 (13 376 men and 10 743 women) and the 132 private HCPs 15 330 (8 424 men and 6 906 women) patients. A small number of prescriptions (n=1 038) were excluded due to unidentified origin. Statins were defined according to the Anatomical Therapeutical Chemical (ATC) classification system code C10AA. [19]

The project was carried out with the approval of and assistance from Statistics Sweden and the Centre for Epidemiology, and was approved by the Regional Ethical Review Board in Lund. In order to protect the identity of the individuals, the research database used arbitrary identification numbers rather than actual personal identification numbers.

Individual-level variables

The outcome variable at the individual level was prescription of *simvastatin* (yes vs. no), regardless of brand, but excluding the original brand ZOCORD®. Simvastatin was the recommended statin in Skåne during the observation period. [20]

As explained above, the *socioeconomic position* of the patient may influence the decision of the prescriber. We expressed the SEP of the patients as disposable family income along with duration of use of social allowance (if any), both measured at the end of 2004. We divided income into quartiles and used the highest income quartile as reference in the comparisons. Social allowance use was divided into the three categories, (i) more than 9 months, (ii) 0 to 9 months, and (iii) no social allowance, with no social allowance as reference.

Adopting an explorative approach, we also included sex (men vs. women) and marital status in the analysis. Age was divided into five groups; (i) ≤49, (ii) 50-59, (iii) 60-69, (iv) 70-79, and (v) 80-89 years, with the ≤49 age group as reference. Marital status was dichotomized as married/cohabiting versus living alone (i.e., single, divorced, or widowed), with married/cohabiting as reference. We also considered the immigrant status of the patients, as we hypothesized that this characteristic might also influence physicians' prescription behaviour. We measured this by a combination of the number of years spent living in Sweden along with the World Bank classification of the individual's birth country, [21] in order to take into consideration the acculturation undergone during many years of living in Sweden as well as taking an economic rather than geographical perspective on country of birth. We categorized the first variable into (i) always lived in Sweden, (ii) more than 13 years in Sweden, (iii) 5-14 years in Sweden, and (iv) 0-4 years in Sweden. The first category was used as a reference in the analysis. We categorized country of birth into (i) low income, (ii) lower middle income, (iii) upper middle income, and (iv) high income countries. High income countries were used as reference in the analysis. While these variables should not directly affect adherence to prescription guidelines, they may reflect social roles and cultural expectations which in turn might determine prescription of recommended drugs. [6]

Area-level variables

In previous studies, we have shown that physicians working at private practices have a much lower adherence to prescription guidelines; [2, 3] this might stem from poorer receptivity to the county council policies, and these circumstances might modify the effect of the other included variables. It is also known that private care attracts more high-SEP patients than does public care. [22, 23] Hence, our analyses took the administrative status (private vs. public) of the HCPs into consideration.

HCPs with an elevated number of high income patients may develop therapeutic traditions conditioned by the high income of those patients, and once established these traditions could extend themselves to all patients. We operationalized this possibility by computing the percentage of high-income patients at the HCP. This variable was divided into three groups by tertiles, and the group with the highest percentage was used as reference.

Proximity to specialized care and the particular type of knowledge that it conveys might influence adherence to prescription guidelines. Hence, we also identified those HCPs that employed specialist physicians other than GPs. In the analyses, HCPs employing GPs alone were used as reference in the comparisons.

There are several potential influences on drug prescription, such as information diffusion and marketing forces, [24] which may be influenced by the population density of the area. We therefore considered whether the HCP was located in a rural or an urban area according to the definition provided by the Swedish Association of Local Authorities and Regions. [25] Of the 33 municipalities in Skåne, those municipalities that were classified as metropolitan areas (n=1), suburban municipalities (n=6), or large and medium sized towns (n=10) were categorized as urban areas (n=17). The other 16 municipalities were categorized as rural areas, and were used as reference in the analysis.

Statistical analysis

The analyses were stratified by sex and performed for private and public facilities separately. We used *multilevel logistic regression analysis* to estimate the probability of prescribing a recommended statin, while accounting for the hierarchical structure of the data (i.e., patients nested within HCPs that in turn were nested within HCAs). HCPs and the publicly administrated HCAs were included in the analysis as random terms.

We developed three consecutive models. Model A included the random area parameters only, in order to partition the variance of prescription of recommended statins to different levels. Model B included the individual covariates age, income, social allowance, marital status, country of birth, and number of years in Sweden. Finally, model C added the area-level variables for percentage of prescriptions given to high-income patients, whether the HCP employed a specialist physician or GP, and whether the HCP was situated in a rural or urban area. This allowed us to investigate whether these contextual characteristics explained residual variation at the HCP levels.

For the fixed-effects parameters of the model, we calculated prevalence ratios (PR). We estimated the parameters in the WinBugs software, and stored the results from each step in the iteration procedure (5000 iterations). For each step, we calculated, for parameters of

interest, the prevalence ratio. This gave us a distribution of prevalence ratios and from this distribution we calculated the median and corresponding 95 % credible interval (95 % CI). In the random-effects part of the multilevel analysis, we obtained the variance at the HCP and HCA levels. To quantify therapeutic traditions we calculated the intra-class correlation (ICC) using the simulation method. With the simulation method, the values estimated on the logistic scale are transformed to the binary scale. As the ICC depends on the predictors in the model, we calculated the ICC for every income group in model C. [26, 27]
To calculate the percentage of change in the magnitude of clustering that was explained by including individual or contextual characteristics in the model with more variables (Var_{more}), we used the variance obtained in the empty model as reference ($Var_{reference}$) :

$$\text{Percentage of change} = ((Var_{reference} - Var_{more})/(Var_{reference}))x100$$

We used this percentage to estimate the relevance of the individual and contextual characteristics for understanding a possible clustering of prescriptions of recommended statins. [2, 3]

Results

More patients visited publicly-administered HCPs (60%) than privately-administered ones (40%), and more men than women received a statin prescription (Table 1). The highest income quartile contained more men than women; and public HCPs catered for more low-income patients than high-income patients, while the situation was reversed for private HCPs (Figure 1). Adherence to guidelines was systematically lower among private HCPs. Women lived alone to a higher degree than men. In terms of immigrant status and SES, 90% of the patients were born in high-income countries and 2% received social allowance.

Overall, men and women did not differ in terms of being prescribed a recommended statin ($PR_{publicHCP}$ = 1.00 [95% CI: 0.99 – 1.02] and $PR_{privateHCP}$ = 1.02 [95% CI: 0.99-1.04]). Among men, compared with the youngest age group, men over 70 had higher prevalence of recommended statin. However, among women, those aged 70-79 treated at private practices had lower probability of receiving a recommended statin.

Individual high income and cohabitation were both associated with a lower adherence to guidelines for men but not for women (Table 2).

There was no clear association between the percentage of high-income patients at the HCP and adherence to prescription guidelines, except for men treated at public HCPs where a lower percentage of such patients was associated with higher adherence to guidelines (Table 2). Moreover, men treated at private HCPs in urban areas received recommended statins more rarely than those treated at HCPs in rural areas.

Table 1: Adherence to guidelines for statin prescription and characteristics of the 34 449 patients on statin prescription during the period July–Dec 2005 in the Skåne region of Sweden.

	WOMEN		**MEN**	
	Private Care	*Public Care*	*Private Care*	*Public Care*
Recommended statins (%)	65	79	65	79
Number of individuals	6 906	10 743	8 424	13 376
Mean age	68	69	66	66
	% recommended statins/ % of individuals		*% recommended statins/ % of individuals*	
Married/Cohabiting	65/55	79/52	67/73	81/69
Living alone	65/45	79/48	65/27	79/31
Disposable family income				
• Low income, Q1	66/26	80/30	67/20	80/25
• Middle low income, Q2	64/27	79/30	67/20	81/24
• Middle high income, Q3	64/25	79/23	65/27	79/26
• High income, Q4	64/22	77/17	64/34	77/25
Use of social allowance				
• None	98/52	98/52	66/99	80/98
• 0-9 months	70/0.8	80/0.8	62/0.5	71/0.9
• 10 –12 months	65/0.8	84/1	50/0.6	74/1
Country of birth				
• High income country	65/92	79/92	66/92	80/92
• High middle income country	62/4	76/3	60/3	70/3
• Low middle income country	59/4	81/5	61/4	78/5
• Low income country	62/0.3	80/0.4	72/0.2	75/0.5
Number of years living in Sweden				
• Always	65/85	79/84	66/86	80/85
• >14 years	61/12	77/12	63/11	77/11
• 5-14 years	66/3	79/4	59/3	78/4
• 1-4 years	81/0.4	87/0.7	69/0.8	72/0.9

In model A, the ICC_{HCP} value for men in the private sector was 10.4 %, which indicate that factors varying between HCPs to a high degree influence the prescription of recommended statins (Table 3). However, factors at the HCP/HCA level seemed to be less relevant in the public sector illustrated by a lower ICC. Even though the higher levels seemed to be less relevant the HCP level seemed to be more important than the HCA level. This pattern was similar for women. The ICC for different income groups in model C was approximately 1 % in the public sector and it varied between 7- 9 % in the private sector.

When individual and contextual variables were included, the higher level variance decreased for men by 2% within privately-administered HCPs and 8 % within publicly-administered. For women there seemed to be an increase in variance in model C compared to model A.

Table 2. Association (prevalence ratios) between patient and health care practice characteristics and adherence to statin prescription guidelines in the Skåne region of Sweden, July–Dec 2005. Values were obtained from the fixed effect part of the multilevel regression.

	Women		**Men**	
	Model C public care	**Model C private care**	**Model C public care**	**Model C private care**
Individual variables				
Age (years)				
• 20-49	REF	REF	REF	REF
• 50-59	0.97 (0.91–1.03)	1.01 (0.95–1.11)	1.02 (0.97–1.07)	1.03 (0.98–1.10)
• 60-69	0.97 (0.92–1.03)	0.96 (0.89–1.04)	1.04 (0.99–1.10)	1.03 (0.99–1.10)
• 70-79	0.96 (0.90–1.01)	0.90 (0.82–0.98)	1.06 (1.01–1.12)	1.06 (1.01–1.14)
• 80-89	0.99 (0.93–1.04)	0.95 (0.87–1.03)	1.07 (1.01–1.14)	1.04 (0.99–1.12)
Disposable family income				
• Low income, Q1	1.01 (0.99–1.04)	1.02 (0.98–1.08)	1.04 (1.01–1.09)	1.02 (0.99–1.07)
• Middle low income, Q2	1.01 (0.99–1.04)	1.03 (0.99–1.08)	1.05 (1.01–1.09)	1.03 (1.00–1.08)
• Middle high income, Q3	1.02 (0.99–1.05)	1.02 (0.98–1.07)	1.02 (0.99–1.05)	1.01 (0.98–1.05)
• High income, Q4	REF	REF	REF	REF
Use of social allowance				
• None	REF	REF	REF	REF
• 0-9 months	1.02 (0.93–1.10)	1.03 (0.81–1.20)	0.91 (0.77–1.03)	0.93 (0.70–1.10)
• 10-12 months	1.05 (0.96–1.12)	0.93 (0.71–1.11)	0.99 (0.79–1.04)	0.95 (0.74–1.09)
Country of birth				
• High income	REF	REF	REF	REF
• High middle income	1.01 (0.96–1.06)	1.00 (0.90–1.09)	0.88 (0.77–0.96)	0.98 (0.89–1.06)
• Low middle income	1.04 (0.99–1.09)	0.99 (0.87–1.08)	1.00 (0.91–1.07)	1.05 (0.98–1.13)
• Low income	1.05 (0.90–1.15)	0.99 (0.68–1.21)	0.97 (0.79–1.12)	1.12 (0.90–1.06)
Number of years living in Sweden				
• Always	REF	REF	REF	REF
• 14 years	0.99 (0.95–1.02)	0.99 (0.92–1.04)	1.00 (0.95–1.05)	0.99 (0.94–1.04)
• 5-14 years	0.97 (0.90–1.03)	1.06 (0.96–1.19)	1.03 (0.95–1.12)	0.95 (0.84–1.03)
• 1-4 years	1.07 (0.97–1.17)	1.15 (0.95–1.36)	0.96 (0.82–1.09)	1.04 (0.90–1.17)
Marital status				
• Married/Cohabiting	REF	REF	REF	REF
• Living alone	1.01 (0.99–1.03)	1.02 (0.99–1.05)	1.04 (1.04–1.08)	1.03 (1.01–1.07)
Contextual variables				
% of high-income patients				
• T1	1.02 (0.97–1.09)	1.00 (0.89–1.16)	1.06 (0.99–1.17)	0.92 (0.81–1.05)
• T2	1.03 (0.99–1.13)	0.97 (0.86–1.07)	1.10 (1.02–1.22)	0.96 (0.85–1.06)
• T3	REF	REF	REF	REF
Specialist physician (yes vs. no)	1.01 (0.92–1.06)	0.91 (0.79–1.02)	1.02 (0.91–1.14)	0.96 (0.85–1.06)
Urban versus rural area	0.95 (0.89–1.00)	0.95 (0.85–1.11)	0.97 (0.89–1.04)	0.84 (0.74–0.95)

Table 3. Random effects part of the multilevel regression analysis of adherence to statin prescription guidelines in Skåne region, Sweden
(numbers within parenthesis are 95 % credible intervals)

	Women		**Men**	
	Public HCPs	**Private HCPs**	**Public HCPs**	**Private HCPs**
Variance				
$HCP_{Model\ A}$	0.27 (0.18-0.41)	0.70 (0.52-0.97)	0.24 (0.16-0.35)	0.75 (0.56-1.04)
$HCA_{Model\ A}$	0.08 (0.00-0.36)	-	0.06 (0.00-0.24)	-
$HCA+HCP_{Model\ A}$	0.36 (0.24-0.64)	-	0.31 (0.20-0.49)	-
$HCP_{Model\ B}$	0.28 (0.19-0.42)	0.72 (0.52-1.00)	0.23 (0.16-0.35)	0.75 (0.55-1.04)
$HCA_{Model\ B}$	0.07 (0.01-0.32)	-	0.05 (0.01-0.22)	-
$HCA+HCP_{Model\ B}$	0.37 (0.24-0.62)	-	0.30 (0.20-0.49)	-
$HCP_{Model\ C}$	0.29 (0.19-0.43)	0.72 (0.52–1.01)	0.22 (0.14-0.35)	0.73 (0.53–1.02)
$HCA_{Model\ C}$	0.06 (0.00-0.37)	-	0.05 (0.00-0.24)	-
$HCA+HCP_{Model\ C}$	0.36 (0.23-0.70)	-	0.28 (0.18-0.49)	-
ICC				
HCP_{ModelA}	1.2 %	9.3 %	0.9 %	10.4 %
$HCA+HCP_{ModelA}$	1.9 %	-	1.5 %	-
$HCP_{Model\ C\ Low\ Income}$	1.1 %	8.6 %	0.9 %	8.5 %
$HCP_{Model\ C\ Middle\ low\ Income}$	1.1 %	8.5 %	0.9 %	8.4 %
$HCP_{Model\ C\ \ Middle\ high\ Income}$	1.1 %	8.7 %	0.9 %	7.3 %
$HCP_{Model\ C\ High\ income}$	1.2 %	8.9 %	1.0 %	8.8 %

HCA= Health care area
HCP=Health care practice
ICC=Intra class correlation

Discussion

This study illustrates that the physician's decision to prescribe a recommended statin is conditioned by the socioeconomic (e.g. income, marital status) and demographic (e.g. age) characteristics of the patient. This situation cannot be justified by any medical argument, but may rather reflect the influence of constructed social roles and cultural expectations.[6] For example, men with a lower income were prescribed the cheaper recommended statins to a higher degree than men with a high income. Similarly, older men were prescribed the recommended statins less frequently than younger patients with the same need. This socioeconomic and demographic inequity was similar among private and public HCPs, even though private HCPs generally had a lower adherence to guidelines. From the perspective of equity in health care, our study brings into question physicians´ choice of more expensive, but not more efficient, brands for some groups of patients, given that a large part of this medication expenditure is funded by the public reimbursement system.

Interestingly, in this stratified analysis, we found that among men but not among women, low income and living alone were associated with a higher prescription of recommended statins. Moreover, older women had a lower adherence than younger women, while the situation was the reverse among men, though these results were not conclusive. In general, our results have implications for the achievement of equity of health service policy, since there is no medical

or therapeutic reason that could justify the selective prescription of expensive statins to younger men or to patients of high SEP. One rationale for this behaviour might be that sociological forces influence physicians' prescription decisions over and above evidence-based knowledge. [8, 9, 28, 29] Patients of higher SEP may be more aware and have better communication skills, making it easier to express their demands and expectations and to be more involved in the treatment decision. [30]

This discriminatory prescription pattern cannot lead to any harm for the patient, since all statins have a similar efficacy. However, although the current study focuses on statin prescription, we believe that our results are generalizable to other medical treatments in primary health care. In some contexts, lack of access to recommended treatments could have more severe consequences for the individual. Prescription of non-recommended drugs is also an inappropriate behaviour from a cost-effectiveness perspective. Our study points out that these sociological forces should be considered from a perspective of equity in access to health care in general and when trying to implement prescription guidelines in routine care in particular.

Beyond individual characteristics, the contextual circumstances of the HCPs evidenced an independent association with adherence to prescription guidelines. For example, over and above the characteristics of the patient, HCPs with a low percentage of high-income patients tended to prescribe the recommended statins more often than HCPs with an overall higher level of patient income. However, the inclusion of contextual characteristics did not explain a major part of the variance at the higher level.

Our results also suggest the existence of therapeutic traditions, acting at the HCP level, which influence the prescription behaviour of individual physicians. Based on the ICC measure, we observed that physicians from the same HCP, especially in the private sector, exhibited a similar propensity to prescribe recommended statins. Moreover, private HCPs had both higher clustering of similar behaviour and systematically lower adherence to guidelines, and this pattern remained after the inclusion of individual and contextual characteristics.

Observational studies are often the only option for investigating questions that for reasons of feasibility, costs, or ethics cannot be analyzed by randomized trials. [31, 32] In our study, we used multilevel regression analysis, which not only produces more correct statistical analysis but also provides information about the role that different health care levels play in understanding drug prescription and utilization. Moreover, since the prevalence was rather high in this study we calculated PRs instead of the usual odds ratios. [33] In addition, Sweden has a long tradition of register-based epidemiology, and the registers we used in this study seem to have an acceptable validity as evaluated in previous studies. [34]

Our results suggest that the physician's decision to prescribe a recommended statin is conditioned by the socioeconomic (e.g. income, living alone) and demographic (e.g. age) characteristics of the patient. Beyond individual characteristics, the contextual circumstances of the HCPs, especially in the private sector, also showed an independent association with adherence to prescription guidelines. An increased understanding of the connection between the SES of the patient and the decisions made by physicians might be of relevance when planning interventions aimed at promoting efficient and evidence-based prescription.

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Competing interests

None

Figure legends

Figure 1: Percentage of patients in different income groups (women to the left and men to the right). The Y-axis shows the percentage of patient and the X-axis the different income groups.

What is already known on this subject?

- Studies have shown that sociological factors influence clinical decision-making; and so the physician's behaviour might be affected by social roles and expectations related to the gender, age, or socioeconomic position of the patient.

What this study adds

- Independently of the patient's needs, the physician's adherence to guidelines for statin prescription is conditioned by the socioeconomic (e.g. income) and demographic (e.g. age) characteristics of the patient; this leads to inequity in the distribution of health care resources.
- Beyond individual characteristics, there is an independent association between the contextual circumstances of the health care practice and its adherence to prescription guidelines.

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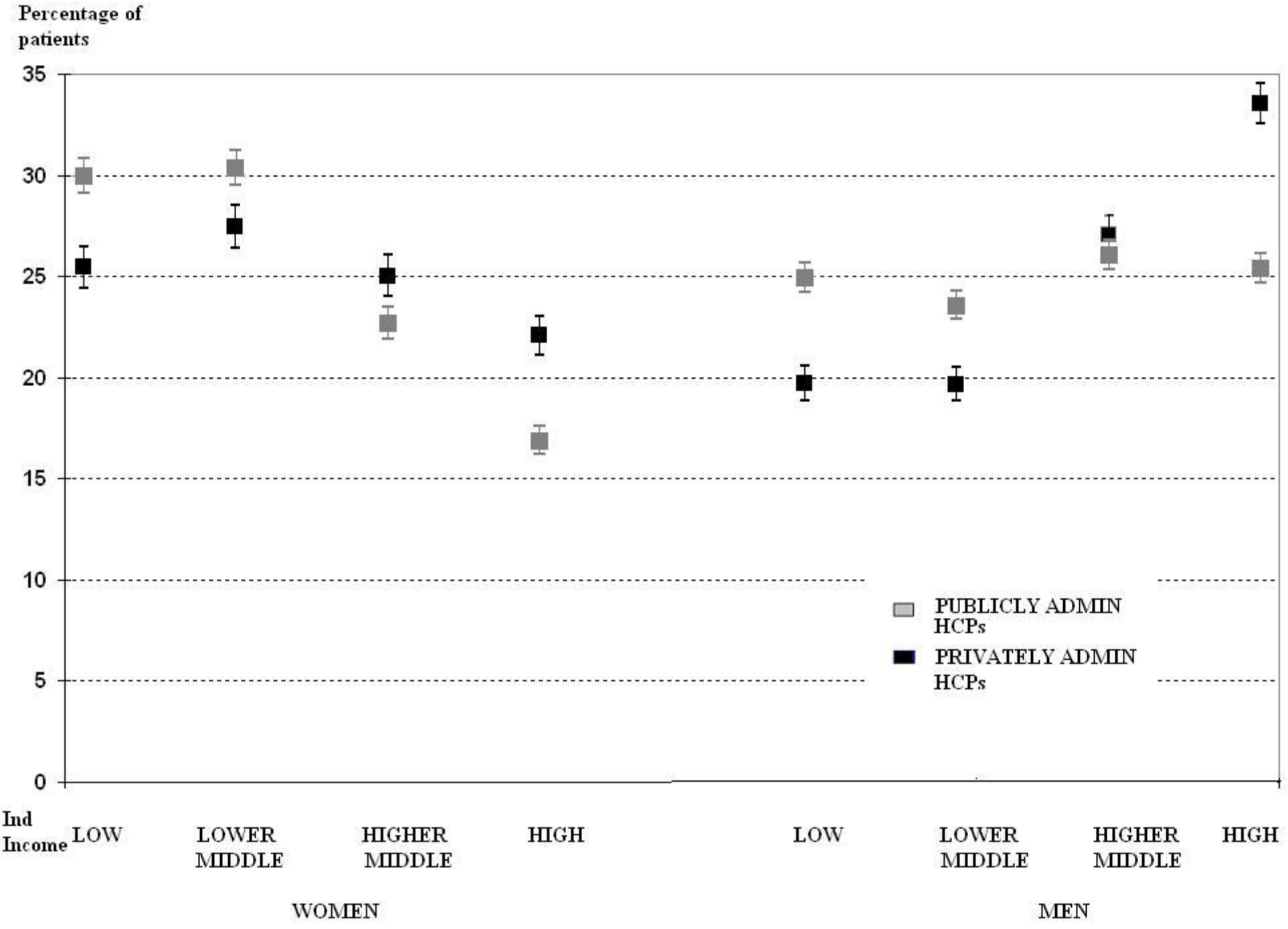
Percentage of patients
35
30
25
20
15
10
5
0
PUBLICLY ADMIN HCPs
PRIVATELY ADMIN HCPs
Ind Income
LOW
LOWER MIDDLE
HIGHER MIDDLE
HIGH
LOW
LOWER MIDDLE
HIGHER MIDDLE
HIGH
WOMEN
MEN