

Socioeconomic correlates of drug use based on prescription data:

A population-based cross-sectional register study in Denmark 1999

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ABSTRACT

Introduction: In the public health system we study medical treatment which is ideally provided according to need and independently of economic means. We report use of prescription drugs according to socioeconomic classifications in North Jutland County in Denmark in 1999.

Method: We conducted a register-based cross-sectional study of 385,879 persons aged 18 years or older. Data from the computerized accounting system from the pharmacies were linked with records of socioeconomic status (SES) in the Prevention Registry at Statistics Denmark. We identified all prescriptions redeemed in North Jutland County from 1 January through 31 December 1999 and classified the socioeconomic status for each individual based on the annual registration of income/social benefits, employer, occupation and education. We computed the proportion of persons redeeming at least one prescription and computed weighted averages of prescription proportions for each SES.

Results: The highest prevalence of medication use was by persons in early retirement, old age pensioners, people on disability pension and others outside the workforce. We found only minor differences among different economically active groups with slightly more male top managers using cardiovascular drugs. People in the upper half of the socioeconomic scale were somewhat less likely to redeem prescriptions for treating muscle, joints and bone, and central nervous system.

Conclusion: Social or economic barriers in buying medicine are generally small in Denmark and do probably not provide a likely explanation for the social differences in morbidity and mortality.

INTRODUCTION

Social inequalities in morbidity and mortality have been described in many countries, regardless of the existence in those countries of a public healthcare system [1-3]. It is unknown whether such social inequalities apply to the use of prescription drugs, or whether social inequalities in drug use explain part of the social inequalities in health. Studies of individual drug use and socioeconomic status have shown no substantial differences in several countries [4-6]. However drug consumption is known to vary among regions of the world; in 1985, for example, the developing countries accounted for only 15-20% of the global drug bill although they comprise 75% of the world's population [7].

The rapid increase in the number of prescription and non-prescription drugs on the market coincides with an increasing demand for healthcare. There are large variations in rates of prescription drug use both among individuals within the same country and among countries, and one of the determinants may be related to the cost of the treatment. Among other important factors drug consumption include the scientific and technological advancement of the health

care sector, the structure and organization of the healthcare with its priority and reimbursement systems, and the disease pattern [7].

With the exception of the studies on use of antidepressants [8], hormone replacement therapy [9] and statins [10] – drug utilization studies in Denmark have mainly focused on use of individual drugs, categorized according to their Anatomical Therapeutic Chemical (ATC) group, age, gender, and duration of therapy [11, 12]. Use of medication among social groups has been studied with self-reported data [13] or on population samples that were subject to selection bias related to non-response [14].

In this paper, we report the use of prescription drugs according to socioeconomic status in the entire adult population in North Jutland County in Denmark in 1999.

MATERIAL AND METHODS

STUDY POPULATION

We conducted this register-based cross-sectional study in North Jutland County, whose nearly 500,000 inhabitants constitute approximately 9% of the Danish population. It is a rural area of Denmark with only one city of more than 100,000 inhabitants. We had data on all 385,879 persons aged 18 years or older, registered with a permanent address in the county on 1 January 1999.

The county is served by pharmacies equipped with a computerized accounting system from which data are sent to the Danish National Health Service. A copy of data are stored in a research prescription database in the Department of Clinical Epidemiology at Aarhus University.

All Danish residents have a unique civil registration number, which is assigned at birth and encodes gender and birth date. This number is used in most administrative registers, permitting linkage of individual prescription records with records of socioeconomic status stored in the Prevention Registry at Statistics Denmark.

Using the prescription database, we identified all prescriptions redeemed in North Jutland County from 1 January through 31 December 1999 and linked these data to the Prevention Registry at Statistics Denmark.

DATA ON SOCIOECONOMIC STATUS (SES)

Classification of socioeconomic status (SES) was based on the annual registration of income, social benefits, employer, occupation, level of education, and age, these data are collected from tax returns and public registers [15].

The classification of SES was introduced in 1995. The population is divided into three main groups: the employed, the unemployed, and persons outside the work force. The group of employed individuals is subdivided into self-employed, assisting spouses, and salaried employees. The group of self-employed is subdivided into those with and those without employees. The group of salaried employees is subdivided according to the "skills" needed to master the job defined through both formal education and informal training and experience. The skill-based categories of salaried employees are:

- (i) top managers in companies, organizations, public sector, and law-making;
- (ii) upper-level salaried employees (e.g., schoolteachers, medical doctors, nurses, researchers, midwives, academic workers);
- (iii) intermediate level workers (e.g., social workers, technicians, financial workers, administrative workers);
- (iv) basic level workers (e.g., clerks, sales- and service-workers, homecare helpers, craftsmen); and
- (v) other salaried employees (e.g., cleaners, messengers, unskilled workers)

The classification was based on the International Standard Classification of Occupations, ISCO-88 [16] (Table 1).

In 1999, the Danish pension age was 67 years with a possibility of early retirement at age 60 for members (minimum of 20 years) of an

Table 1. Socio-economic classification, based on a national version of ISCO-88 (Dominant occupation in year).

Employed	Self-employed	With employees Without employees
	Salaried employees	Top Managers Upper level Intermediate level Basic level Other
	Employees, not further specified Assisting spouses	
Unemployed	Students Disability pension Early retirement allowance Old-age pension Other economically inactive	

Table 2. Anatomical Therapeutic Chemical Classification System (ATC).

A	Digestive tract and thyroid
B	Haematology
C	Cardiovascular system
D	Dermatology
G	Urogenital system
H	Hormones for systemic use
J	Systemic treatment of infections
L	Antineoplastic and immunosuppressive agents
M	Muscle, joints and bone
N	Central nervous system including strong analgesics
P	Systemic treatment of parasites
R	Respiratory system
S	Eye and ear
V	Varia

Table 3. Crude percentages of redeeming at least one prescription in 1999 according to main groups of medication and socioeconomic classification.

	no. men	% users of medication in main groups*					
		A	C	J	M	N	R
Self-employed with employees	6417	8.7	10.2	25.5	16.7	8.5	9.3
Self-employed without employees	9242	7.8	10.8	22.6	15.7	9.5	9.8
Top managers	4604	7.9	13.2	21.4	14.5	6.9	9.8
Salaried employees, upper level	13465	5.8	8.8	20.5	11.7	6.7	12.5
Salaried employees, intermediate level	12886	6.3	7.9	21.2	13.1	6.6	11.1
Salaried employees, basic level	59201	6.0	5.8	22.2	15.4	6.6	9.3
Salaried employees, other	13960	7.0	7.0	22.6	18.4	8.2	9.3
Employees, not further specified	5619	4.4	3.3	20.7	11.6	4.9	9.0
Assisting spouses	82	13.4	17.1	23.2	18.3	12.2	15.9
Unemployed	4462	9.0	9.4	21.7	16.4	10.4	9.3
Students	5748	2.8	1.3	15.7	8.0	3.9	10.1
Disability pension	9170	27.7	30.4	30.5	25.2	50.9	18.5
Old-age pensioners	29099	32.7	50.4	31.3	20.6	35.6	20.4
Early retirement benefit	9088	17.3	29.3	24.1	17.6	16.7	13.4
Other economically inactive persons	7873	10.3	8.8	22.3	18.5	19.8	10.2
All men	190916	12.1	15.9	23.8	16.4	14.5	12.1

	no. women	% users of medication in main groups*					
		A	C	J	M	N	R
Self-employed with employees	1472	8.7	12.2	37.8	19.1	10.9	12.9
Self-employed without employees	3100	7.9	11.3	31.8	16.6	12.3	13.0
Top managers	1136	6.3	11.5	34.7	16.1	10.7	15.0
Salaried employees, upper level	10377	5.9	8.9	31.5	13.2	9.6	14.3
Salaried employees, intermediate level	20096	6.7	8.5	34.4	15.4	10.3	14.4
Salaried employees, basic level	51042	7.3	9.9	36.2	19.1	11.1	14.3
Salaried employees, other	8221	8.7	14.2	34.2	22.0	13.4	13.7
Employees, not further specified	6062	6.5	8.1	36.5	16.9	9.6	13.9
Assisting spouses	1877	9.6	16.0	29.1	18.0	13.5	10.9
Unemployed	5494	9.6	12.6	36.3	19.1	14.7	15.7
Students	7795	4.6	3.1	33.4	14.0	7.4	14.5
Disability pension	13142	31.3	38.3	41.7	31.9	54.7	26.6
Old-age pensioners	40671	37.6	57.6	36.7	25.6	47.2	18.6
Early retirement benefit	10964	17.7	32.3	33.2	20.3	21.8	17.3
Other economically inactive persons	13514	12.2	12.0	36.8	22.1	20.3	15.6
All women	194963	16.0	23.0	35.8	20.7	22.7	16.2

*) A: Digestive tract and thyroid; C: Cardiovascular system; J: Systemic treatment of infections; M: Muscle, joints and bone; N: Central nervous system including strong analgesics; R: Respiratory system.

unemployment insurance programme. Included in the early retirement group were people above the age of 50 on transitional allowance or part-pension.

The group of other economically inactive persons primarily comprised social security recipients, while persons under the age of 67 who retired early due to disability were placed in a separate group.

DATA ON MEDICINE USE

The National Health Service provides, for all Danish residents, tax-supported health care including free access to general practitioners and hospitals; it also partially refunds the costs of most physician-prescribed drugs. From the computerised accounting system, reimbursement data are transferred to the Pharmacoepidemiological Prescription Database (PPD).

We used the PPD to identify all 3,012,816 prescriptions reimbursed in North Jutland County during 1999. In addition, we obtained from PPD data on the type of reimbursement (full or partial); type of drug prescribed; date of purchase; and the personal identification number. Included are reimbursements regarding prescriptions on over-the-counter medicine.

The prescription medications were classified according to the ATC classification system [17] (Table 2). We report data on the most frequently used ATC groups: digestive tract and thyroid (A), cardiovascular system (C), systemic treatment of infections (J), muscle, joints and bone (M), central nervous system including strong analgesics (N), and respiratory system (R).

STATISTICAL ANALYSIS

Redeeming at least one prescription during 1999 was considered as the outcome in this cross-sectional study, and proportion of persons

Table 4. Prevalence rate ratio of redeeming at least one prescription in 1999 according to main groups of medication and socioeconomic classification (salaried employees, basic level are used as reference).

MEN	Adjusted prevalence odds ratios with 95% confidence intervals											
	Digestive tract and thyroid (A)	Cardiovascular system (C)	Systemic treatment of infections (J)	Muscle, joints and bone (M)	Central nervous system including strong analgesics (N)	Respiratory system (R)						
Self-employed with employees	1.09	1.00-1.20	1.00	0.91-1.10	1.15	1.08-1.22	0.94	0.88-1.01	1.02	0.93-1.12	1.01	0.92-1.10
Self-employed without employees	0.94	0.87-1.03	0.97	0.90-1.05	0.97	0.92-1.02	0.89	0.84-0.95	1.18	1.09-1.27	1.03	0.96-1.11
Top managers	0.95	0.85-1.06	1.26	1.14-1.39	0.92	0.85-0.99	0.77	0.71-0.84	0.78	0.69-0.88	1.07	0.96-1.18
Salaried employees, upper level	0.79	0.73-0.86	1.04	0.97-1.11	0.89	0.85-0.93	0.64	0.61-0.68	0.84	0.78-0.90	1.38	1.30-1.46
Salaried employees, intermediate level	0.92	0.85-1.00	1.07	0.99-1.16	0.92	0.88-0.97	0.75	0.71-0.80	0.87	0.81-0.94	1.21	1.14-1.29
Salaried employees, basic level	1.00		1.00		1.00		1.00		1.00		1.00	
Salaried employees, other	1.08	1.01-1.17	1.03	0.95-1.11	1.01	0.97-1.05	1.19	1.13-1.24	1.18	1.10-1.26	1.00	0.94-1.07
Employees, not further specified	0.94	0.82-1.08	1.00	0.85-1.16	0.94	0.88-1.01	0.85	0.78-0.93	0.96	0.85-1.09	0.94	0.85-1.03
Assisting spouses	1.52	0.80-2.88	1.33	0.74-2.42	0.99	0.59-1.65	1.00	0.57-1.75	1.42	0.73-2.75	1.80	0.99-3.25
Unemployed	1.29	1.16-1.44	1.14	1.02-1.27	0.96	0.89-1.03	0.98	0.90-1.07	1.43	1.29-1.58	0.99	0.89-1.10
Students	0.82	0.69-0.97	1.15	0.90-1.46	0.71	0.66-0.77	0.66	0.60-0.73	1.03	0.89-1.19	1.03	0.93-1.13
Disability pension	3.85	3.62-4.09	2.98	2.80-3.17	1.46	1.38-1.53	1.52	1.44-1.60	11.11	10.51-11.74	2.12	1.99-2.26
Old-age pensioners	2.29	2.11-2.50	2.07	1.92-2.23	1.08	1.00-1.16	0.96	0.89-1.04	3.45	3.17-3.75	1.69	1.55-1.85
Early retirement benefit	1.47	1.35-1.59	1.40	1.30-1.50	0.96	0.90-1.03	0.89	0.83-0.96	1.91	1.76-2.07	1.22	1.12-1.34
Other economically inactive persons	1.76	1.62-1.91	1.47	1.34-1.61	1.00	0.95-1.06	1.25	1.18-1.33	3.63	3.40-3.87	1.07	0.99-1.15

with the outcome was termed "prescription proportion". First, we calculated the one-year prevalence proportion of ever-use of prescription medicine for each SES group. (We defined the one-year prevalence proportion as the percentage of persons redeeming at least one prescription during the year).

Second, for each socioeconomic group, weighted averages of prescription proportions were computed. The weights were based upon the distribution of age and gender in the entire study population. The formula of standard errors used for estimating 95% confidence intervals (CI) was based upon basic probability calculus. The variance of a weighted average of proportions is itself a weighted average of the variances of the separate proportions. The variance weights are the corresponding fixed population weights squared. We used logistic regression analysis to obtain relative prevalence estimates for consumption of specific types of medication using "salaried employees, basic level" as the reference group.

Estimates of relative prevalence proportions were adjusted for age (in seven age groups: 18-29, 30-39, 40-49, 50-59, 60-69, 70-79, 80+) and degree of urbanization as characterized by the size of the largest town of the persons' home municipality (three groups: city with 100,000+ inhabitants, provincial town with 10,000-99,999 inhabitants, and rural area with less than 10,000 inhabitants).

RESULTS

The lowest prescription proportions were observed among the students, the self-employed, the managers, and the salary earners at top and medium levels. The highest prescription proportions were observed among persons in early retirement, old-age pensioners, people on disability pension, and other people out of the workforce (Table 3). In all medication groups women were more likely than men to redeem at least one prescription.

The differences in medication use among employed people tended to be small. For ATC-group C (heart and circulatory diseases), male top managers were more likely to redeem prescriptions than others, while the opposite was the case for female top managers and salaried employees above basic level. For respiratory system and asthma medicine, male salary-earners at top and medium levels had a higher prescription proportion than salary earners at basic level after adjustment for age and degree of urbanization (Table 4 and Table 5). We found that top managers and salaried employees above the basic level had a lower rate of redeeming drugs relating to muscle, joints and bone, and central nervous system.

DISCUSSION

We found only minor differences in patterns of redeeming the studied medication types within different economically active groups. People in the upper half of the socioeconomic scale were slightly less likely to have purchased medicines relating to muscle, joints and bone, and the central nervous system. Male top managers were somewhat more likely and female top managers were somewhat less likely to have used cardiovascular medicine. Some variation was also found for respiratory system medicine.

Our cross-sectional design has several limitations. First, the variables were measured simultaneously over a short time period (one year), precluding a conclusion about the direction of any association between SES and drug use. Further, we did not take the amount of medicine prescribed into consideration, but we do not expect this to change the pattern of drug use we present.

We conducted the study in North Jutland County which primarily is a rural area and our results might not be representative for the whole country.

The PPD include data on all county residents redeeming one or more prescriptions. Some prescriptions redeemed outside North Jutland County (by persons who are travelling to work, for example), will not be registered in the county database. However, we expect that the extent of such under-reporting is negligible for the findings of our study.

Table 5. Prevalence rate ratio of redeeming at least one prescription in 1999 according to main groups of medication and socio-economic classification (salaried employees, basic level are used as reference).

WOMEN	Adjusted prevalence odds ratios with 95% confidence intervals					
	Digestive tract and thyroid (A)	Cardiovascular system (C)	Systemic treatment of infections (J)	Muscle, joints and bone (M)	Central nervous system including strong analgesics (N)	Respiratory system (R)
Self-employed with employees	1.07	0.81-1.13	1.10	0.95	0.83-1.09	0.88
Self-employed without employees	0.90	0.65-0.83	0.87	0.79	0.72-0.87	0.90
Top managers	0.72	0.69-1.00	0.98	0.74	0.63-0.87	1.03
Salaried employees, upper level	0.71	0.62-0.73	0.83	0.60	0.57-0.64	0.97
Salaried employees, intermediate level	0.88	0.75-0.84	0.92	0.74	0.71-0.77	0.99
Salaried employees, basic level	1.00	1.00	1.00	1.00	1.00	1.00
Salaried employees, other	1.06	1.03-1.18	0.95	1.14	1.08-1.21	0.94
Employees, not further specified	0.98	0.89-1.09	0.99	0.94	0.88-1.01	0.98
Assisting spouses	0.97	0.71-0.92	0.81	0.86	0.76-0.97	0.75
Unemployed	1.23	0.94-1.13	1.03	0.97	0.90-1.04	1.10
Students	0.92	0.94-1.25	0.82	0.85	0.79-0.91	1.03
Disability pension	3.99	2.36-2.61	1.45	1.86	1.78-1.95	2.14
Old-age pensioners	2.99	2.09-2.41	1.17	1.43	1.32-1.54	1.60
Early retirement benefit	1.61	1.28-1.45	1.08	1.07	1.00-1.14	1.24
Other economically inactive persons	1.77	1.13-1.29	1.03	1.25	1.19-1.31	1.10

The PPD also has some intrinsic limitations. Since only reimbursed medications are registered, data on some medicines, such as benzodiazepines, were absent. Moreover, registry data have no information on the indication for medication use or the actual use of purchased drug. At the same time the database is considered complete and accurate for redeemed medicine with less than 0,5% coding errors [18].

The prevention registry is created by pooling data from different registries and that may be subject to coding errors. If coding of the socioeconomic classification leads to misclassification, this will most likely be independent of drug use with the expectation that it would bias the estimates of relative prevalence towards their null values.

As expected, we found that people outside of work force bought more prescription medicine than other groups, possibly because health problems prevented them from being employed. Among people in the work force, some differences may be driven by social determinants rather than health determinants, such as the greater use of cardiovascular medicine among male managers.

Socioeconomic differences in use of medicine may reflect socioeconomic differences in health and/or socioeconomic differences in seeking medical help and/or socioeconomic differences in how the health care system responds to health problems. In this descriptive study we have no data to identify single aspects of these causal chains. Our aim was only to describe how large socioeconomic differences are in the studied age ban of the population. Our expectation was that these differences would be larger than they actually were. We know, that there are socioeconomic differences in health that would indicate a large use of medicine among the less well off and without economic barriers in buying medicine that should lead to a large consumption among less well paid people. In the ATC-groups we studied, we only found minor differences within the different economically active groups.

CONCLUSION

We found only slight socioeconomic differences among the subgroups of the working population for redeeming prescribed medicine. We conclude that the social or economic barriers in buying medicine in Denmark are small, for most types of medicine, and these small differences hardly cause any substantial social differences in morbidity and mortality. Small differences in overall use do not exclude larger differences for specific types of medicine that could play a roll for specific diseases.

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References

1. Black D, Morris JN, Smith C, Townsend P, Whitehead M. Inequalities in health. The Black report; The health divide. London: Penguin Group 1988.
2. Kapral MK, Wang H, Mamdani M, Tu JV. Effect of socio-economic status on treatment and mortality after stroke. *Stroke* 2002; 33: 268-73.
3. Breckenkamp J, Laaser U. (The German Cardiovascular Disease Prevention Study: Social gradient in use of drugs with a potentially addictive nature. An analysis of selected indications groups). *Med Klin (Munich)* 1999; 94: 306-13.
4. Rabin DL, Bush PJ. Who's using medicines? *J Community Health* 1975; 1: 106-17.
5. Kasper JA, Wilson R. Use of prescribed medicines: a proxy indicator of access and health status. *Int J Health Serv* 1983; 13: 433-42.
6. Scott A, Shiell A, King M. Is general practitioner decision making associated with patients' socio-economic status? *Soc Sci Med.* 1996; 42: 35-46.
7. Drug utilization studies. Methods and uses. Introduction. WHO Regional Publications, European Series, No. 45, 1993.
8. Hansen DG, Sondergaard J, Vach W, Gram LF, Rosholm JU, Mortensen

- PB et al. Socio-economic inequalities in first-time use of antidepressants – a population-based study. *Eur J Clin Pharmacol* 2004; 60: 51-5.
9. Olesen AV, Johnsen SP, Mortensen JT, Boggild H, Olsen J, Sorensen HT. Socioeconomic status and use of postmenopausal hormone replacement therapy among Danish women. *Acta Obstet Gynecol Scand* 2005 Jul;84 (7):639-44.
 10. Thomsen RW, Johnsen SP, Olesen AV, Mortensen JT, Boggild H, Olsen J et al. Socioeconomic gradient in use of statins among Danish patients: population-based cross-sectional study. *Br J Clin Pharmacol*. 2005 Nov; 60(5):534-42.
 11. Lægemedelstatistik 1998-2002, København: Danmark. Lægemedelstyrelsen, august 2003.
 12. Hallas J, Nissen A. Individualized drug utilization statistics. Analysing a population's drug use from the perspective of individual user. *Eur J Clin Pharmacol*. 1994;47:367-72.
 13. Kjølner M, Rasmussen NK. Sundhed og sygelighed i Danmark 2000, Statens Institut for Folkesundhed, 2002.
 14. Nielsen MW, Gundgaard J, Hansen EH, Rasmussen NK, Use of six main drug therapeutic groups across educational groups: self-reported survey and prescription records. *J Clinical Pharmacy Therapeutics* 2005;30: 259-69.
 15. Statistics Denmark's Socio-economic Classification, 1st edition, 1997. (In Danish.)
 16. Statistics Denmark's Classification of Occupational Skills, 1st edition, 1996. (In Danish.)
 17. Guidelines for ATC and DDD. Geneva: World Health Organization Collaborative Centre for Drug Statistics Methodology 1996.
 18. Olsen JH, Sorensen HT, Friis S, McLaughlin JK, Steffensen FH, Nielsen GL et al. Cancer risk in users of calcium channel blockers. *Hypertension*. 1997;29:1091-4.