SHORT REPORT

Community income and surgical rates in the Netherlands

G P Westert, J P J M Smits, J J Polder, J P Mackenbach

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Background: The study describes variations in use of surgical procedures by community income in the Netherlands. From the literature it is known that surgical rates have a socioeconomic gradient. Both positive and negative associations of socioeconomic factors of patients (for example, income, education) with surgical rates have been reported. The question raised here is: how do (possible) socioeconomic variations in surgery in the Netherlands compare with variations observed elsewhere?

Data and Methods: The data comprised Dutch hospital discharges and population estimates for 1999. Socioeconomic status was indicated by a patient's income and based on the average family income of the postcode area of residence. Poisson regression was used to compute relative incidence (odds ratios) for 10 common surgical procedures. The model included age, gender, degree of urbanisation, and province of residence.

Results: The association between surgical rates and community level income is rather weak. For half of the surgical rates the authors observed higher utilisation rates in communities with low income levels, but the differences are small. The range of odds ratios in the lowest income quintile group (compared with the group with the highest income) observed is: 0.87 to 1.18. Men from a low income community received more appendicectomies (1.18), cholecystectomies (1.12), knee replacements (1.06), and prostatectomies (1.14) and less tonsillectomies (0.90). Women from a low income community received more appendicectomies (1.12), caesarean sections (1.18), hip and knee replacements (1.05, 1.17), and hysterectomies (1.14). Whereas they received less coronary artery bypass grafts (0.92), cholecystectomies (0.87), and tonsillectomies (0.92).

Conclusions: Compared with findings reported in the international literature, this study indicates that variations in use of surgical procedures by community income in the Netherlands are comparatively small. Because of lack of data the authors could not study the influence of variations in need for surgical care by community income, but as the incidence of conditions requiring surgical interventions generally is higher in lower income groups, it is suspected some degree of underutilisation exists in these groups.

In the Western world, significant variations in surgical rates between population groups have been observed over the past decades. Most studies relating socioeconomic factors to rates of surgical procedures have been carried out in the USA, Canada, and Scandinavia.¹ Gittelsohn *et al* showed that race and community income level are important factors in differential hospital utilisation rates.² Discretionary surgeries increase with income while medical admissions decline with income. The higher income groups receive coronary artery procedures whereas the lower income groups are hospitalised for coronary artery disease.³ Anderson *et al* wrote that coronary artery bypass surgery varied little by income in Canada,

but in New York and California rates increased steadily with the income of area of residence.³ Ancona *et al* report that the coronary artery bypass graft (CABG) rate was lower among men in the most socially disadvantaged group, measured at community level, but that hospital admissions because of ischaemic heart disease were much higher for the second factor.⁴ Findlay *et al* found a strong influence of social deprivation on the uptake of both cardiac catheterisation and coronary artery bypass surgery in Scotland.⁵

Keskimäki *et al* reported¹—in a study using individual socioeconomic data—pronounced differences in rates across socioeconomic categories for several procedures. For cataract operations and hip replacements due to arthrosis or deformity, the surgery rates favoured the better off despite low social status being considered a risk factor for these disorders. The correlation of disposable family income with hysterectomy and prostatectomy rates, and the low surgery rates for many procedures in the lowest income quintile also suggested socioeconomic disparities in access to services. Keskimäki concludes that in general the overall use of short-term somatic inpatient care seemed to be distributed across socioeconomic groups more or less according to need, but in specific cases such as access to coronary bypass operations “inappropriate socioeconomic” differences were observed.⁶

Van Doorslaer *et al* reported that in a comparative study in 10 European countries and the US the lower income groups are more intensive users of the healthcare system. However, after standardisation for differences in healthcare needs, they had little or no evidence of significant inequity in overall delivery of health care. Though in half of the countries, significant pro-rich inequity have been emerging for medical specialist contacts. The authors concluded that the inequity was mainly caused by a higher use of medical specialists by people from higher income groups and a higher use of GP care among low income groups.⁷

In this article we aim to find out whether the finding from abroad (USA, Canada, Finland) that surgical rates seem to be positively associated with socioeconomic factors, such as income, are also observed in the Dutch healthcare system with all citizens listed to GPs and no financial barriers for equal access to GPs and hospital and specialist care. In the Netherlands, patients with varying income levels have equal access to all general (92) and academic (8) hospitals. Private hospitals that perform surgical procedures analysed in this study do not exist in the Netherlands. Finally, there are no financial incentives for doctors to perform either less or more surgery on patients with varying income levels in general hospitals or academic clinics.

METHODS

Data

The data comprised all Dutch hospital discharges and population at risk figures for 1999 by community level. The discharge data used cover all hospital treatments (inpatient and day care) and were provided by Prismant. The reliability of the data provided by Prismant is good. Prismant collects the data directly from the 100 Dutch hospitals and not from insurers.

Table 1 Selected surgeries per capita (10000), Netherlands, 1999

Procedure	Procedure code	Cases	Per 10000	Age range
Appendectomy	5470-1/9	15134	9.6	all
CABG	5361-3	10088	12.6	40-89
Caesarean section	5470-1/9	24279	33.9	15-44
Cataract operation	5142-9	84064	37.6	>30
Cholecystectomy	5510-3	24988	18.3	>20
Hip replacement	5815/6	26227	29.0	>40
Knee replacement	5814	11500	19.6	21-94
Prostatectomy	5601-5	11562	40.3	>50
Tonsillectomy	5281-3/4-5/9	66740	26.2	<60
Hysterectomy	5682-7	16136	24.5	>25

Table 2 Performed surgeries and odds ratios for community income, men and women, Netherlands, 1999

	Men income*					Women income*						
Procedure	Low	I	II	III	IV	High V	Low	I	II	III	IV	High V
Appendectomy	1.18	1.14	1.13	1.03	1.0		1.12	1.06	1.04	0.98	1.0	
CABG	1.00†	1.09	1.10	1.02	1.0		0.92	0.96	0.97	0.92	1.0	
Caesarean section	–	–	–	–	–		1.18	1.18	1.18	1.09	1.0	
Cataract operation	0.95	1.04	1.01†	1.02	1.0		1.00†	1.06	1.03	0.96	1.0	
Cholecystectomy	1.12	1.10	1.10	1.02	1.0		0.87	0.96	0.94	0.96	1.0	
Hip replacement	0.98	0.97	0.99†	0.93	1.0		1.05	1.07	1.02	0.98	1.0	
Knee replacement	1.06	1.04	1.00†	0.92	1.0		1.17	1.10	1.08	1.00†	1.0	
Prostatectomy	1.14	1.09	1.07	1.05	1.0		–	–	–	–	–	
Tonsillectomy	0.90	1.06	1.02	1.00†	1.0		0.92	1.00†	1.03	0.98	1.0	
Hysterectomy	–	–	–	–			1.14	1.07	1.00†	1.00†	1.0	
Number of ORs <0.95 or >1.05	5	5	4	2	–		7	6	3	2	–	

*High income (group V: OR=1.00) reference category. - not applicable. †p>0.05

Admission and discharge and surgical procedure data corresponded in a recent internal audit in more than 90% of the cases with patient files in the corresponding hospitals (Prismant, 2002). The indicator of a person's socioeconomic position was based on average family income in the surrounding community of residence, defined by the four digit postcode area. We used the average disposable income of income receivers with 52 weeks of income living in the area. As no correlation was found between this indicator and average family size (-0.04), the indicator used was not weighted for family size. The income information was derived from the Regional Income Survey 1998 of Statistics Netherlands. Community level was chosen because individual or household income data cannot be linked to hospital discharge data at this level.⁸ We distinguished 3968 four digit post code areas with on average 4000 inhabitants. The postcode area or community income scores were regrouped into five quintiles, each covering 20% of the areas.

Study design

Table 1 describes the study population and shows the surgical procedures selected for the analysis. The 10 procedures covered roughly one fifth of the total number of all surgical procedures performed in the Netherlands in 1999. All procedures included in the analysis were performed as primary procedures. All Dutch patients that received one of the ten procedures were included.

Poisson regression was used to compute odds ratios per surgical procedure. The model includes gender, age (0-4, 5-9, . . . , 95 and older), degree of urbanisation (five classes), and province of residence (n=12) and community income (five classes). The combination of these variables comprise the rows of the database (n=12 000). Per row the population at

risk and the observed number of surgical patients, for the 10 procedures separately, were added. The age ranges shown are defined by the presence of empty cells outside the printed range in the final column of table 1. A total of 1174 rows are empty.

Degree of urbanisation and province of residence were added to adjust for possible regional variation in surgery within the country. The observed regional variation will not be described in this paper.

RESULTS

Table 2 shows that in general, both for men and women, the odds ratios for income do not deviate much from the index value (1.00). However, most of the ORs are statistically significant, predominantly caused by the large number of cases in the model. For this reason we decided to mark ORs between 0.95 and 1.05 as not relevant. In income quintile groups I and II—lowest average income, indicating the contrast with the highest income group—two third of the odds ratios deviated more than ($\pm$) 0.05 from the index value. The final row of table 2 reports that for men 10 of 16 ORs were observed outside the -0.95 and 1.05 range and for women 13 of 18. For men 90% of these ORs has a positive sign. For women 10 of 13 ORs report that persons from the lowest group had more surgeries.

The highest OR observed were 1.18: appendectomy (men) and caesarean section (women) in the lowest income quintiles, meaning that persons in the lowest income stratum had more appendectomies or caesareans. The lowest OR is 0.90 for men and 0.87 for women in the lowest income group, indicating that the lowest income group had less tonsillectomies (men) and less cholecystectomies.

In summary, men from a community with a low income received more appendectomies (1.18), cholecystectomies

(1.12), knee replacements (1.06), and prostatectomies (1.14). Men in the lowest income groups received less tonsillectomies (0.90).

Women with low income received more appendicectomies (1.12), caesarean sections (1.18), hip and knee replacements, (1.05, 1.17) and hysterectomies (1.14). Whereas they received less CABGs (0.92), cholecystectomies (0.87), and tonsillectomies (0.92).

DISCUSSION

People living in lower income communities had a slightly higher chance of surgery of the following type: appendicectomy, caesarean section, cholecystectomy (men), prostatectomy, knee replacement, hip replacement (women), and hysterectomy. In lower income communities people tend to use less cataract procedures (men), tonsillectomies, CABGs (women), and cholecystectomies (women).

From a review of studies performed in the past two decades we know that the incidence of disease varies with socioeconomic position in the Netherlands.⁹ As incidence of disease was not adjusted for in the empirical model—these data are not available at an appropriate geographical level—we might have expected ORs indicating higher use among the lower income groups. This study is not convincing in showing this. The highest OR is only 1.18.

How do these results compare with findings by studies from abroad reporting in general that surgeries increase with income.¹⁻⁵ Gittelsohn *et al*²—the clearest case—reported a strong positive relation between community income level and (discretionary) surgical rates. In their study the OR (high income/low income) presented for total hip replacement and hysterectomy was 1.2, for tonsillectomy 1.3 and various vascular procedures had ORs between 1.5 and 1.8. Appendicectomy and prostatectomy showed insignificant ORs.

Gittelsohn *et al* published ORs based on \$20 000 difference in median income between small areas. Our paper uses a slightly different approach, but we think that a comparison is still meaningful and indicative for the differences between Maryland and the Netherlands, because there is a bigger income gap between the Dutch communities: quintile I (low) compared with V (high).

As we have no reason to believe that the results have changed much in the past decade in the US and the Dutch analysis was performed using data with more contrast in community income, we may conclude for 2000 that compared with the US lower income groups in the Netherlands deviate less from the higher income groups in relative incidence of surgery.

The weak associations found in our analysis were partly caused by the fact that we used community data for income level. Hospital records do not include a patient's socioeconomic position; level of education or income. Including socioeconomic data of patients in the hospital records will prove their worth in research, and therefore, in health policy making and monitoring of inequalities in hospital care utilisation. As an alternative to this ideal situation average socioeconomic status information of the areas or communities in which people live was used. This approach was applied in various other studies.¹⁰⁻¹³ Keskimäki, in his review of the literature on this point, concludes that socioeconomic variations in surgical rates have usually been studied via survey data or by using the socioeconomic structure in the population of the patient's resident area as a proxy for socioeconomic status.¹ In most cases, the areas used for this purpose are rather large, ranging from a few thousands to over twenty thousand inhabitants. This may lead to substantial measurement error because not everybody in the area has the same socioeconomic status. Given the fact that smaller areas are on average more homogeneous, the approximation of the effects of individual socioeconomic status can be expected to be better when the

area for which aggregated information is available is small.^{14 15} A bad measurement of a variable will generally lead to weaker associations (at least when the error is not systematic). Therefore, the effects of socioeconomic status, indicated by community income, on health care utilisation or health computed on the basis of these area measures probably underestimate the real effect.

We have used four digit postcode areas, which have on average 4000 inhabitants. In the Netherlands socioeconomic status information is available on lower levels of aggregation (for example, areas with about 40 inhabitants in 15 households), but these cannot be used because the hospital data are not (yet) released on lower levels of aggregation.

However, compared with the analysis by Gittelsohn *et al*,² reporting stronger effects of community income level on surgical rates, the size of the communities we used is very small. They used communities with on average 38 260 inhabitants. That is 10 times the sizes of the communities used in our study.

The real size of underestimation of the findings in our study is hard to guess. Parallel studies that compared socioeconomic variation in mortality on community data with 40 inhabitants per area, 1500 per area and 6600 per area indicate that the change in OR is not very large. Smits *et al* report that for male mortality the ORs range from 1.28 to 1.39. The difference between 40 and 6600 inhabitants per area is thus 39% and 17% respectively.¹⁶

We analysed income variation in primary surgical procedures, reflecting morbidity roughly on a one to one basis (for example, appendicitis and appendicectomy). As the 10 chosen surgical procedures include procedures that are not discretionary (for example, hip replacement after fracture, appendicectomy) the observed differences between income groups in fact follow differences in morbidity. In the case of appendicitis, it is hard to imagine that the ORs observed (table 2) reflect unequal access to surgical care. They simply reflect differences in morbidity by income. As hip replacements include fractures and arthrosis we cannot say anything definite about socioeconomic distribution of elective hip replacements.

In the case of caesarean sections, where we observed more procedures performed in the lower income quintile, data limitations forced us to chose all women in the age range 15–44 as the denominator instead of cesareans related to number of normal deliveries, inside and outside hospitals. It could be argued that cesarean rates per population give spurious results, because normal deliveries vary considerably by socioeconomic status in many countries.

The study indicates that there are some procedures that were performed more frequently in lower income groups. Apart from differences in morbidity, high intervention frequencies may also indicate inappropriate or poor quality of care. Evidence for this is scarce in the international literature and to our knowledge Dutch research is lacking on this point.

The main shortcoming of our study relates to the fact that we did not have data on variations in need for surgical procedures by community income, for example, incidence of appendicitis, ischaemic heart disease, or osteoarthritis of the knees. These data are not available in the Netherlands. As a consequence, it is reasonable to suspect that this incidence is generally higher in lower income groups. Ischaemic heart disease is a good example: epidemiological studies in the Netherlands clearly show higher incidence, prevalence, and mortality from this condition in lower income groups.¹⁶ A recent small area study of mortality, similar in design to the study reported here, showed that mortality rates from IHD are higher (OR 1.41) in the lowest quintile of neighbourhoods.¹⁶ Assuming that the CABG rates reflect the total revascularisation rates in the Netherlands—PTCAs and CABGs are to some extent substitutes in the treatment of ischaemic heart disease, but as we have not ordered data on PTCAs for this study, we were not able to check this assumption—the fact that CABG rates are

not higher in lower income groups suggests that ischaemic heart disease patients from lower income groups are clearly underserved by CABG in the Netherlands, as they are in Finland,⁶ the UK,⁵ and the USA.² However, the degree of underutilisation by the lower income groups, observed for some procedures, is less in the Netherlands than elsewhere.

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Authors' affiliations

G P Westert, J J Polder, Centre for Prevention and Health Services Research and Public Health Forecasting, National Institute for Public Health and the Environment, Bilthoven, Netherlands

J P J M Smits, Department of Economics, Nijmegen School of Management, Nijmegen, Netherlands

J J Polder, J P Mackenbach, Department of Public Health, Erasmus University Rotterdam, Rotterdam, Netherlands

Correspondence to: Dr G P Westert, Centre for Prevention and Health Services Research, National Institute for Public Health and the Environment, PO Box 1, 3720 BA Bilthoven, Netherlands; gert.westert@rivm.nl

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