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Health Inequalities among Persons with Type 2 Diabetes: The Example of Intermittent Claudication

Gesundheitliche Ungleichheit bei Typ-2-Diabetes: das Beispiel Claudicatio intermittens (Schaufensterkrankheit)

Zusammenfassung

In Deutschland wird allen Krankenversicherten eine sehr gute Gesundheitsversorgung angeboten. Die weitergehende Frage nach sozialen Unterschieden bei Inanspruchnahme und Qualität der gesundheitlichen Versorgung wird jedoch nur selten untersucht. Diese Unterschiede werden hier anhand einer Gruppe von Personen mit Typ-2-Diabetes analysiert. Um die sozialen Unterschiede in dieser Patientengruppe bewerten zu können, wird zudem eine weitere Gruppe von Personen ohne Diabetes einbezogen. KORA-A ist eine Fall-Kontroll-Studie, die Patienten mit Typ-2-Diabetes aus den MONICA-Surveys S2 (1989/90) und S3 (1994/95) und dem Herzinfarktregister umfasst sowie Kontrollen, die nach Alter und Geschlecht zu den Fällen gemacht wurden. In den Jahren 1997/98 wurden diese Personen zur Teilnahme an KORA-A eingeladen. Ausgewertet werden konnten Daten von 378 Typ-2-Diabetikern. Die Gruppe ohne Diabetes umfasst 438 Personen. Die Ergebnisse weisen darauf hin, dass die Prävalenz von „Schmerzen in den Beinen beim Gehen" mit abnehmender Schulbildung zunimmt und dass dieser Zusammenhang bei Typ-2-Diabetikern (OR 3,53; 95% KI 1,32 – 9,44) stärker ist als bei Nicht-Diabetikern (OR 2,02; 95% KI 0,97 – 4,23). Die Verringerung des Auftretens von Claudicatio intermittens ist ein wichtiges Ziel der gesundheitlichen Versorgung von Diabetikern. Das Auftreten dieser Komplikation kann daher als Merkmal für die Qualität der gesundheitlichen Versorgung dienen. Offenbar sollte die gesundheitliche

Abstract

In Germany, high quality health care is offered to just about all socio-economic groups. The question is rarely asked, though, if there are social differences in the utilisation and quality of health care among those with similar needs. These differences are analysed by looking at a group of persons with type 2 diabetes mellitus. Another group of persons without diabetes is included as well. The data are taken from the KORA-A Study in Augsburg, southern Germany. KORA-A is a case-control study based on patients with type 2 diabetes from the MONICA surveys S2 (1989/90), S3 (1994/95) and the Myocardial Infarction Registry, and controls, matched by age and sex to the cases. In 1997/98, these persons were contacted for the KORA-A study. The dataset includes data from 378 type 2 diabetic patients. The group without diabetes comprises 438 persons. The results indicate that the prevalence of "pain while walking" increases with decreasing educational level, and that this association is stronger for persons with type 2 diabetes (OR 3.53; 95% CI 1.32 – 9.44) than for persons without diabetes (OR 2.02; 95% CI 0.97 – 4.23). The prevalence of intermittent claudication can serve as an indirect assessment of the quality of health care received by diabetic persons. It is concluded that health care should be improved especially for those persons with type 2 diabetes who belong to the group with low socioeconomic status.

note
The KORA study group consists of H.-E. Wichmann (speaker), H. Löwel, B. Giesecke, R. Holle, J. John and co-workers who were responsible for the design and conduct of the KORA studies.

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Versorgung vor allem bei den Typ-2-Diabetikern verbessert werden, die der unteren Sozialstatusgruppe angehören.

Schlüsselwörter
Gesundheitliche Ungleichheit · Gesundheitsversorgung · Typ-2-Diabetes

Key words
Health inequalities · health care · type 2 diabetes

Introduction

For some years health inequalities have been a "hot topic" in Germany. Many papers and books have been published, repeatedly showing that low socio-economic status (SES) is associated with increased morbidity [1, 2]. German data on socio-economic differences in mortality are still quite rare, but the available information clearly indicates that mortality is higher for lower SES groups, too (e. g. [3, 4]). The prevalence of many risk factors, such as smoking and obesity, has also repeatedly been shown to increase with decreasing SES. Despite this rather large body of knowledge little is known about SES differences concerning health care. This may be due to the widespread assumption that the German Statutory Health Care System guarantees a high level of equity, that access to and utilisation of health care hardly depend on the socio-economic status of the person in need of health care. In Germany, about 90 % of the population is covered by the Statutory Health Care System, including just about all lower income groups, and the basket of benefits is nearly identical for all insured. Thus, it can be stated with great confidence that high quality health care is offered to all socio-economic groups. The more important question, if there are SES differences in the utilisation and quality of health care among the insured with similar needs, is rarely asked.

SES differences in the utilisation and quality of health care can be analysed best if the need for health care is taken into account, e. g. by focussing on a specific disease. The study presented here is based on this approach, looking at a group of persons with type 2 diabetes mellitus. Diabetes mellitus is well suited for an exemplary examination of SES differences in health and health care. Its prevalence increases with decreasing SES (e. g. [5]); there are standards for adequate health care in diabetic patients; and it is associated with severe complications (e. g. coronary heart disease, stroke, peripheral vascular disease, renal failure, blindness), most of which can be prevented or delayed by adequate health care and compliance [6 – 8]. Good diabetes care should aim not only at achieving glycaemic control, but also at reducing or delaying the occurrence of diabetic complications such as peripheral vascular disease (PVD). Pain while walking and at rest indicate different levels of intermittent claudication, the cardinal symptom of PVD. An examination of pain while walking and at rest can therefore serve as an assessment of the quality of health care received by diabetic persons.

Some studies (e. g. on asthma, [9]) indicate that health inequalities increase with disease severity, and it can be hypothesized that the same is true for diabetes. In the present study, two groups with different levels of (multi-)morbidity are differentiated by including diabetic persons with and without previous myocardial infarction (MI). Our dataset also includes a group without diabetes. This "control group" can serve as a comparison group for evaluating the SES differences in the type 2 diabetes group.

Methods

The data for the analyses are taken from the KORA-A Study ("Kooperative Gesundheitsforschung in der Region Augsburg": Co-operative Health Research in the Region of Augsburg) [10, 11]. KORA-A is based on participants from the MONICA surveys conducted in the region of Augsburg, Southern Germany [12, 13]. These surveys were conducted in 1989/90 (S2) and 1994/95 (S3) among a representative sample of residents aged 25 – 74 (about 5,000 persons per survey). In addition, since 1984 all hospital cases in the Augsburg region with myocardial infarction (MI) are recruited for the "Augsburg MI registry" [14, 15]. In 1997/1998, all persons with diabetes mellitus who had been identified by these different sources were contacted for the KORA-A study. A control group of persons without diabetes was chosen from the same sources, with frequency matching by age and sex (and for the MI registry also by year of myocardial infarction).

The analyses are restricted to those diabetic subjects, who stated in the previous studies (i. e. in the MONICA-surveys S2 and S3 or in MI registry) that a doctor had diagnosed their diabetes, and who repeated this statement in the KORA-A study. Based on these self reports it can be assumed with great confidence that these persons really do have diabetes. The "control group" of persons without diabetes includes only those participants who stated in the previous studies that they had never been told by a doctor that they have diabetes. The KORA-A Study also includes an oral glucose tolerance test among this "control group", and all those with newly diagnosed diabetes were excluded from this group.

The two data sources "MI registry" and "MONICA surveys S2 and S3 do not overlap, i. e. no participant is part of both sources. Also, participants who said in the MONICA survey interview that they did have a MI, but who were not included in the MI registry, were excluded from the survey group. Thus, there are four clearly distinct groups: persons with diabetes and persons without diabetes, with each of these groups further divided into persons having a clinically confirmed MI (taken from the MI registry) and persons without a MI diagnosis (taken form the surveys).

As part of the KORA-A study all participants were interviewed and they also completed a questionnaire. For the present analysis, some information was taken from the interview (i. e. age, sex, highest level of education, diabetes). From the questionnaire, the

answers to the following questions have been analysed as markers for symptomatic peripheral vascular disease or peripheral neuropathy:

a) Do you have pain in the legs on walking?
b) Do you have pain in the legs at rest?

For both questions the answering categories "yes" or "no" were given. The first question is a marker for symptomatic peripheral vascular disease, a potential complication of diabetes that can be avoided or delayed through appropriate and high quality health care. The second question both may reflect symptoms of painful peripheral neuropathy or severe peripheral vascular disease.

SES was assessed by the variable "highest level of education". The three standard categories of the German educational system were used, indicating a low (Hauptschule, Volksschule), medium (Mittlere Reife, Realschule) or high level (Abitur, Abschluss einer Hochschule oder Universität etc.). In a first step, we performed a number of bivariate analyses, with $p < 0.05$ (χ^2 test) as the limit for statistical significance. In a second step, the association between educational level and pain in the legs was further analysed by logistic regressions, with all variables included as dichotomised variables. For the independent variable (i. e. level of education), the lowest level was used as the reference. Three potential confounders were included, i. e. age (three groups), sex, and previous MI (yes/no). All analyses were conducted with the statistical software package SAS (version 8.2).

Results

From the MONICA surveys S2 and S3, 413 diabetic patients were identified, 363 (87.9%) of whom still lived in the study region. Of these, 224 participated in the study, yielding a response rate of 61.7%. From the MI registry, 463 diabetic subjects were identified, with 384 (82.9%) still living in the study region. Among these, 274 participated in the study, yielding a response rate of 71.4%. As mentioned above, participants who stated in the MONICA survey interview that they did have a MI, but who were not included in the MI registry, were excluded from the survey group (n = 21). We also excluded persons with type 1 diabetes (n = 20), and restricted our analyses to those type 2 diabetic patients, who stated in the previous studies (MONICA, MI registry) and again in the present KORA-A study that they had type 2 diabetes. Finally, data from 378 diabetic patients were included, 168 from the survey and 210 from the MI registry.

Concerning persons without diabetes, 459 persons were identified from the MONICA surveys S2 and S3, 425 (92.6%) of whom still lived in the study region. Of these, 232 participated in the study, yielding a response rate of 54.6%. From the MI registry, 572 persons were identified with 501 (87.6%) still living in the study region. Among these, 283 participated in the study, yielding a response rate of 56.5%. Participants who had been invited to the KORA-A study as non-diabetic persons (based on self-report in the previous MONICA surveys or MI registry), but who were identified in the KORA-A study as having diabetes (either by self report or by the oral glucose tolerance test) were excluded (n = 66). We also excluded those participants who stated in the MONICA survey interview that they did have a MI, but who were not included in the MI registry. Finally, data from 438 persons without diabetes were included, 203 from the survey and 235 from the MI registry. The basic description of these patients is presented in Table **1**. It shows, for example, that high educational level is quite rare in this sample with a mean age of about 69 years.

The prevalence of "pain in the legs" is presented in Table **2**. About 51% of all persons with type 2 diabetes report to have pain in the legs on walking, and about 29% report to have pain in the legs at rest. Both pain while walking and at rest is more prevalent among persons with type 2 diabetes as compared with persons without diabetes. This difference is seen at most educational levels, and it is greater for "pain while walking" than for "pain at rest". The present paper focuses on the differences by educational level, and the analyses show that "pain while walking" steadily increases with decreasing educational level, with the prevalence in the low educational group about twice as high as in the high educational group. Concerning "pain at rest", the same picture emerges for persons with type 2 diabetes, but for persons without diabetes the association is less clear. A statistically significant association is found only for "pain while walking".

A number of logistic regressions were performed, both for "pain while walking" and for "pain at rest" as the dependent variable. For each dependent variable one set of models was tested for persons with type 2 diabetes and another set for persons without diabetes. In each of these sets, the first model included educational level only, and in a stepwise procedure the succeeding

Table **1** Study population of KORA-A Augsburg (1997/98), a case-control study, based on participants of the MONICA surveys S2 (1989/90) and S3 (1994/95) and the Augsburg Myocardial Infarction Registry

	Number (%)			
	persons without diabetes		*persons with diabetes*	
previous myocardial infarction (MI)				
– no[1]	203	(46)	168	(44)
– yes[2]	235	(54)	210	(56)
highest level of education				
– low	308	(71)	283	(75)
– medium	75	(17)	71	(19)
– high	53	(12)	23	(6)
(missing values)	2	–	1	–
age				
– 33 to 59 years	65	(15)	55	(14)
– 60 to 69 years	145	(33)	131	(35)
– 70 to 87 years	228	(52)	192	(51)
– mean/standard deviation (years)	68.8/8.5		68.5/8.2	
sex				
– men	289	(66)	257	(68)
– women	149	(34)	121	(32)
	438	(100.00)	378	(100.00)

[1] participants from the MONICA-Surveys S2 and S3
[2] participants from the myocardial infarction registry

models additionally included age, sex and the presence of previous myocardial infarction (yes/no).

Concerning "pain while walking" among persons with type 2 diabetes, the first model (including educational level only) showed increased odds ratios for medium and low education as compared with high education, and these odds ratios changed little when age, sex and the presence of a previous myocardial infarction were controlled for. A very similar picture was seen for "pain while walking" among persons without diabetes, but these odds ratios were considerably smaller. For low education, the level of statistical significance is reached in most of these models, the only exception being the models for persons without diabetes controlling for sex and the presence of previous myocardial infarction (see Table **3**) where the level is closely missed. Concerning "pain at rest", similar odds ratios for educational level can be seen (as compared with the models for "pain while walking"), but these odds ratios where smaller, and none of them reached the level of statistical significance.

Table **3** summarises the results of these analyses, demonstrating that the low educational group suffers more from pain in the legs than the high educational group, that this association is most pronounced for the dependent variable "pain while walking", and that it is greater for persons with type 2 diabetes as compared with persons without diabetes. In order to test if this health inequality is significantly greater for persons with type 2 diabetes than for persons without diabetes, an additional model included the interaction term "education level × presence of type 2 diabetes". The results show that the differences in health inequalities between persons with and without type 2 remain below the level of statistical significance. The other variables included in the models show the following results (data not shown): both risks (i. e. pain while walking and at rest) are increased in higher age groups, they are higher for women than for men and also for MI patients as compared with non-MI patients. These associations are quite consistent, but in the multivariate analyses only some of these odds ratios are statistically significant. In other models we also included the duration of diabetes (years) and smoking (yes, no) as two more potential confounders, but this hardly changed the odds ratios of the educational level (data not shown).

Table **2** Pain in the legs and educational level: bivariate analysis of the KORA-A study

	number (%)					
	persons without diabetes			*persons with diabetes*		
pain while walking			[1]			[1]
– high level of education	10	(19)		6	(26)	
– medium level of education	19	(25)		30	(44)	
– low level of education	104	(34)	[2]	153	(55)	[2]
	133	(31)		189	(51)	
pain at rest						
– high level of education	9	(17)		4	(17)	
– medium level of education	18	(24)		14	(20)	
– low level of education	63	(21)		91	(32)	
	90	(21)		109	(29)	

[1] comparison between levels of education
[2] $p < 0.05$ (χ^2-test)

Table **3** Pain in the legs and educational level: multivariate analysis of the KORA-A study

	odds ratios (95% conf. interv.)[1]				
	level of education				
	high	*medium*		*low*	
pain while walking					
– diabetes	1.00	2.10	(0.73 – 6.10)	3.53	(1.32 – 9.44)
– no diabetes	1.00	1.19	(0.49 – 2.89)	2.02	(0.97 – 4.23)
pain at rest					
– diabetes	1.00	1.14	(0.33 – 3.95)	2.05	(0.67 – 6.28)
– no diabetes	1.00	1.21	(0.48 – 3.05)	1.13	(0.51 – 2.48)

[1] variables controlled for: age, sex, with or without previous MI

Discussion

The analyses presented above can be summarised in the following way: Pain in the legs generally shows a high prevalence in the examined group of people (mean age about 69 years), but it is particularly high for persons with type 2 diabetes. The prevalence of "pain while walking" increases considerably with decreasing educational level, and this association is stronger for persons with type 2 diabetes than for persons without diabetes. For low education, the level of statistical significance is clearly reached in the sub-sample of persons with type 2 diabetes, and hardly missed in the sub-sample of persons without diabetes. The prevalence of "pain at rest" shows a less consistent association with the educational level. There is a clear gradient for persons with type 2 diabetes only, and the odds ratios are rather small and not statistically significant. It can be concluded that the risk of "pain while walking" is clearly increased in the low educational group, and that this health inequality is substantial, with an odds ratio in the subgroup of "persons without diabetes" of 2.02, reaching 3.53 in the subgroup of "persons with type 2 diabetes".

As outlined in the introduction, pain while walking and at rest can serve as an assessment of the quality of health care received by diabetic persons. Bearing that in mind, our analyses indicate SES differences in an important health care outcome for diabetic persons, and they may also indicate SES differences in the quality of the received health care. Intermittent claudication can be influenced by many factors of course, for example health behaviour. If health care is defined in a narrow sense, some of these factors clearly do not belong to the domain of health care. It can also be argued, however, that health care should address all factors that could be important for health. Based on this broader definition, social differences in health among persons with type 2 would indicate social differences in health care for these patients.

There are a number of limitations of the study which need to be mentioned. It has to be kept in mind that our analyses are based on rather small numbers and should be repeated with larger samples. It is important to stress that the persons with diabetes have been recruited from the general population (i. e. the sample is not restricted to a specific health care institution). However, the KORA-A study population may not be representative for all persons with type 2 diabetes in the Augsburg region. On the one hand, only 62 % of the cases and 55 % of the controls selected from the MONICA surveys S2 and S3 participated in KORA-A (the response rate in MONICA surveys S2 and S3 was about 75 %). On the other hand, the MI participants (response rate 71 %) have been recruited from a MI registry that comprises all hospital cases in the Augsburg region with myocardial infarction. Selective survival could be an issue too, as some persons with diabetes recruited from the two previous MONICA surveys and from the MI registry have died before the start of the KORA-A study. Finally, high education is quite rare in this sample. This skewed distribution limits the statistical analyses, but it is always present in the older age groups in Germany.

Peripheral artery disease (PAD) is not only a major risk factor for lower-extremity amputations, especially in diabetic patients, but also an indicator for cardiovascular and cerebrovascular disease [16]. Intermittent claudication is the most common symptom of PAD, and rest pain indicates a more severe stage of the disease [16]. In the general population, the prevalence of PAD in people aged over 55 years is between 10 – 25 %, however, 70 – 80 % of affected individuals are asymptomatic [17]. The true prevalence of PAD in people with diabetes is difficult to determine. Using the ankle-brachial index (ABI), which may be misleading in diabetic patients due to frequent calcification of arteries yielding artificially higher values, prevalences of PAD varied between 20 to 30 % in elderly people with diabetes [16]. Symptoms may be misleading. Alternative causes of leg pain on walking are many, especially orthopedic problems. Pain at rest may also reflect symptomatic peripheral diabetic neuropathy, which may affect up to 30 % of patients with diabetes [18]. Therefore, a limitation of the present study is the lack of objective measures of PAD (ABI) and neuropathy (neurologic examination). However, this problem relates to all investigated groups. Thus, the observed differences in prevalence probably reflect true differences in morbidity, in particular of peripheral vascular disease.

The result that the risk of "pain while walking" clearly increases with decreasing educational level fits well into the international literature on health inequalities. There is a large body of knowledge about differences in mortality and morbidity by socio-economic status (SES), and also about the determinants of these health inequalities (e. g. [19 – 21]). The overwhelming impression is that mortality and morbidity usually increase with decreasing SES. It is still important, though, to describe the extent and character of health inequalities in more detail, as programmes designed to reduce these health inequalities will have to be designed for each health problem and each health care system specifically. The present study adds a very specific piece of evidence, as it focuses on one particular health problem (i. e. pain in the legs/PVD) as well as on two well defined subgroups of the population (i. e. persons with type 2 diabetes and persons without diabetes). Thus it is possible to formulate relatively precise goals for health policy development such as: Health care for persons with type 2 diabetes should aim at reducing the prevalence of "pain while walking" to the level that persons without diabetes have. Also, the SES differences of "pain while walking" should be reduced as much as possible, especially among persons with type 2 diabetes.

The results presented above also add to the discussion on SES and diabetes. Concerning the prevalence of diabetes, some studies are available from Western European countries, mainly from the United Kingdom. The results show, for example, an inverse association between occupational status and the metabolic syndrome [22]. In a longitudinal design, Chaturvedi et al. [23] compared data on occupational status in 1967/69 with mortality data in 1995. For patients with diabetes they show that mortality in the low occupational group is about twice as high as in the high occupational group. As for Germany, few studies have been published concerning social inequalities in type 2 diabetes. They also show that the prevalence of type 2 diabetes increases with decreasing SES [5, 24].

Regarding health care, there are some hints towards poorer glycaemic control and fewer examinations of the feet and eyes among lower status diabetic persons, but this evidence is sparse and sometimes restricted to the US (e. g. [25]). There are some studies from the UK on the link between HbA1 c levels and SES, some showing an inverse association (e. g. [26]), but others failing to support this result [23]. Concerning Western Europe, presumably the most comprehensive study on diabetes treatment by SES has been conducted in the Netherlands [27]. The data show that low SES is associated with fewer medical checks and with higher prevalences of diabetes complications. From Germany there is no study yet on the association between SES and health care of persons with type 2 diabetes. The best indirect evidence for the hypothesis that the treatment is better for the higher SES groups is provided by two German studies on type 1 diabetes: in a population based sample of 684 adults with type 1 diabetes, micro- and macrovascular complications increase considerably with decreasing SES [28], and another study on 3,674 adult type 1 diabetic patients shows that mortality is increasing with decreasing SES as well [29].

The KORA-A study (from which the data presented above have been taken) provides an empirical basis for studying the associations between SES and diabetes in more detail. Concerning persons with type 2 diabetes, to date the following results have been found [30, 31]:

- knowledge about diabetes increases significantly with increasing SES, especially for those with previous myocardial infarction;
- participation in diabetes training courses increases significantly with increasing SES;
- better glycaemic control (as measured by HbA1 c levels) is significantly associated with higher SES.

This evidence clearly supports the recommendation that better health care should be targeted especially at those persons with diabetes who belong to the low status group. A new KORA study has been conducted in Augsburg from October 1999 to April 2001, including fasting oral glucose tolerance tests (OGTT)

among participants aged 55 or over without known diabetes. The analyses on differences by SES have shown that undiagnosed diabetes is more prevalent among women with low occupational status (as compared with high status women), and that impaired glucose tolerance (IGT) is more prevalent among men with low occupational status (as compared with high status men) [32]. It can be concluded that efforts to detect pre-diabetes and diabetes should be improved especially for low SES groups.

Three messages of the present paper are of primary importance to us.

- SES differences in health status and health care are also present among persons with diabetes, mostly favouring the upper status groups. These differences should be reduced by improving health and health care especially for the low status groups.
- It could be assumed that health inequalities are reduced by health care, as those with more severe health problems should receive more health care. The opposite seems to be the case, though, as the SES differences in health tend to be greater among persons with type 2 diabetes than among persons without diabetes.
- There are many factors which influence the health status of persons with diabetes, for example the individual health behaviour. However, to restrict scrutiny to individual health behaviour carries the risk of victim blaming. Inadequate health behaviour and social inequalities within the latter remain a challenge that should be addressed by health policy and health care professionals.

Future Planning

Many questions are left to be answered concerning social differences in the utilisation and quality of health care, and some of them will be addressed in future KORA studies. One area of research will focus on health care for people with myocardial infarction (MI). It can be hypothesised, for example, that medication differs by the social status of the patient, but to date this has not been analysed in more detail. It can also be hypothesised that the survival time after first MI differs by social status (i. e. that patients with lower social status do not survive as long as patients with higher SES). Again, empirical studies testing this hypothesis are very rare. If such an association is found, the next task will be to disentangle its potential causes. As individual health behaviour and health care are both important for the survival time, it will be important to look at social differences in these determinants, and at the associations between different determinants.

Another area of research will focus on quality of life issues. Quality of life measures are used, for example, for evaluating the individual burden of a specific health status. The hypothesis will be tested that patients having the same disease (e. g. MI or diabetes), but coming from different social backgrounds, differ by their self assessed quality of life, and that these differences can partly be explained by differences in coping resources. Thus, these analyses could contribute to the discussion on the importance of coping resources, and also to the discussion on the need to support specific coping resources for specific social groups.

Last but not least, diseases such as diabetes or MI could lead to financial burden for the patient (e. g. due to co-payments, sickness absence from work, or even job loss). It can be assumed that these problems are more difficult to handle for low SES patients (as compared with high SES patients), but hardly any study has looked at this issue in more detail. The German social security system will probably experience major changes in the near future, and it will be important to monitor the social consequences of these reforms, e. g. the financial burden of disease especially for low SES patients.

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