

Comparison of health inequalities between East and West Germany

ANDREAS MIELCK, ADRIENNE CAVELAARS, UWE HELMERT, KARL MARTIN, OLAF WINKELHAKE, ANTON E. KUNST*

Background: The major objective of the study was to assess whether the extent of health inequalities varies between East and West Germany and whether differences in social inequalities between both parts of Germany are associated with differences in health inequalities. **Methods:** Data were available from a representative sample of 5,311 persons from West Germany and 2,414 persons from East Germany in the same age group (25–69 years). The study protocol was nearly identical in both studies. Socioeconomic status (SES) was assessed by household equivalent income and by educational level. Health status was assessed by perceived general health and by the number of chronic conditions. Absolute differences as well as relative differences (odds ratios) in the morbidity rates between low and high SES groups were calculated. All analyses were performed separately for men and women. **Results:** Income inequalities are larger in West Germany as compared with East Germany, but there are minor differences between East and West Germany concerning educational inequalities and morbidity rates. Just about all measures indicated that health inequalities favouring the upper socioeconomic groups exist in East Germany as well as in West Germany and that there are no significant differences in the extent of health inequalities between both parts of Germany. **Conclusion:** Using two data sets which were raised with nearly identical study protocols, it can be concluded that health inequalities are very stable as they do not seem to differ substantially despite the fact that both parts of Germany have experienced different social systems during the past 45 years.

Keywords: Germany, health inequalities, income inequalities

There is a growing interest in comparing health inequalities between different European countries. The most recent empirical studies have mainly been published by two large international research teams, one headed by van Doorslaer and Wagstaff¹ and one led by Mackenbach and Kunst.^{2–5} The rationale for these comparisons is that cross-country comparisons could help us understand the causes of health inequalities and the potential for reducing them. The major challenge these comparisons are faced with is that it is usually very difficult to compare data which have been raised in different countries. It is particularly interesting to compare health inequalities between East and West Germany, as both parts of Germany shared a long period of common history and culture, then experienced very different socioeconomic and health care systems for approximately 45 years, and are now merging into one system again, accompanied by severe social problems which are mainly in the Eastern part. Thus, it can be assumed that health inequalities differ between East and West Germany. We hypothesised that health inequalities would be larger in West Germany,

as economically the society was probably more egalitarian in East Germany than in West Germany.

Health inequalities favouring the higher socioeconomic groups have been reported in a number of studies from West Germany^{6–8} as well as from East Germany.^{9–11} Studies comparing the extent of health inequalities in the Eastern and Western parts of Germany are rare, though, and those that are available provide information that is difficult to interpret. One study was based on data from 1987.¹² It indicated that health inequalities by educational level were somewhat larger in the East than in the West; but the data were hardly comparable as a representative sample from West Germany was compared with a sample from a single town in East Germany (i.e. Görlitz). Another study was based on a random survey of adults in East and West Germany conducted in 1992.^{13,14} It indicated that health inequalities by educational level, occupational status and income were somewhat smaller in East Germany than in West Germany. The statistical analyses failed to express the magnitude of the health inequalities adequately, though, as the regression coefficients presented in that paper are very difficult to interpret. There is one more study based on a different survey conducted in 1992 in East and West Germany.¹⁵ Using an approach developed in economics which is rarely used in epidemiological studies (i.e. concentration of income and poor health) it indicated that poor health was slightly concentrated in lower income participants and that this concentration was approximately the same in East and West Germany.

* A. Mielck¹, A. Cavelaars², U. Helmert³, K. Martin⁴, O. Winkelhake¹, A.E. Kunst²

¹ GSF-Institute for Medical Informatics and Health Services Research (MEDIS), Neuherberg, Germany

² Department of Public Health, Erasmus University, Rotterdam, The Netherlands

³ Center for Social Policy Research, University Bremen, Germany

⁴ Centre for Epidemiology and Health Research, Zepernick, Germany

Correspondence: A. Mielck, GSF-Institute for Medical Informatics and Health Services Research (MEDIS), 85758 Neuherberg, Germany

A good answer to the question of whether the extent of health inequalities differs between East and West Germany can be obtained by analysing data from two population surveys which were conducted in 1990–1992. These data represent the largest sample available from East and West Germany, they are based on representative samples and the study protocol was nearly identical in both parts of Germany. Based on these data we mainly addressed the following question.

- Are there differences in the extent of health inequalities between East and West Germany?

As part of the analyses, the following questions were addressed as well.

- Are there differences in social inequalities between East and West Germany?
- Are there differences in the overall level of morbidity between East and West Germany?

The analyses primarily focus on the first question, but the other two are included as well as they could help explain the extent of health inequalities. Concerning the second question, there are already some studies indicating that income inequalities are larger in West Germany than in East Germany.¹⁶ Concerning the third question, no clear answer has been provided yet. In West Germany, some health problems seem to be more prevalent (e.g. myocardial infarction), some less prevalent (e.g. hypertension) and others (e.g. general health complaints) about as prevalent as in East Germany.¹⁷ Differences in morbidity rates do not necessarily indicate differences in all-cause mortality rates, but the confusing picture concerning morbidity is still somewhat surprising, as all-cause mortality is clearly higher in East Germany than in West Germany.^{18,19}

METHODS

Data were derived from two studies in East and West Germany which were based on questionnaires and carried out with nearly identical methodologies and protocols. In West Germany, a representative sample of 8,000 persons was chosen from 100 sample points. The survey was conducted in 1990–1991 in the framework of the German Cardiovascular Prevention Study²⁰ and included 25–69 year old German residents. The study design has been described in more detail elsewhere.²¹ Data were available from 5,311 respondents (2,623 males and 2,688 females), yielding a response rate of 69% of those who could be contacted (i.e. excluding those who had moved, whose address was incorrect or who were deceased prior to the start of the survey).

In East Germany, a representative sample of 4,000 persons was chosen from 50 sample points. The survey was conducted in 1991–1992 and focused on 18–79 year old German residents.²² Data were available from 2,509 respondents, yielding a response rate of 70% of those who could be contacted. As the West German survey was confined to the age range 25–69 years, we excluded the age ranges 18–24 and 70–79 years from the East German survey. Thus, in the present analysis 2,414 persons (1,146 males and 1,268 females) could be included from East Germany.

Two indicators of socioeconomic status (SES) were used. The first indicator was based on the net household income (total gross household income minus taxes and social insurance premiums). The 'net household equivalent income' was calculated by the following formula in order to adjust the net household income to the household size: (net household income)/(number of persons in the household^{0.36}). This formula was proposed by Buhmann *et al.*²³ as a simple tool for taking into account the economy of scales induced by an increasing number of household members.

The respondents were asked to mark an income class in the questionnaire. The questionnaire in West Germany included 12 income classes ranging from 'below 1,000 DM' to '7,000 DM and more'; while the questionnaire in East Germany included 12 income classes as well, but these ranged from 'below 500 DM' up to '5,000 DM and more', reflecting the fact that income is lower in the Eastern than in the Western part of Germany. As the formula given above requires an exact income figure, it was assumed that the net household income was equal to the mean of the upper and lower bounds of the marked income class. For the lowest income class, it was assumed that the average income level equals two-thirds of the upper bound, and for the highest income class it was assumed that the mean income level equals four-thirds of the lower bound. The household equivalent income was divided into deciles. Concerning the comparison of the median income per income decile between West and East Germany (*figure 1*), identical income classes were used for both parts of Germany, ranging from 'below 1,000 DM' to '5,000 DM and more'.

The second indicator of SES was the highest educational level achieved by the respondent. Three educational levels were distinguished, i.e. low (primary education), medium and high (university degree). The educational system in West Germany differed from the one established in East Germany, but these three levels provided a good matching of the two systems.

Health status was assessed by two indicators, 'perceived general health' on one hand and 'number of chronic conditions' on the other. The indicator 'perceived general health' was based on exactly the same question in both surveys: 'How would you describe your present state of health: very good, good, satisfactory, less than good, poor?' In a first step we focused the analyses on those respondents who classified their health status as 'less than good or poor'; and, in a second step, we combined these respondents with those who classified their health status as 'satisfactory'.

The question concerning the second indicator was posed slightly differently in both surveys: 'Do you suffer or have you suffered from one of the following diseases?' in West Germany, and 'Have you suffered from one of the following diseases in the previous 12 months?' in East Germany. In West Germany, the respondent was given a list of 34 specific chronic conditions and in East Germany a list of 37 specific chronic conditions was applied. We selected those ten conditions which were listed identically in both

surveys (cancer, diabetes mellitus, hypertension, myocardial infarction, other heart disease or angina pectoris, cerebrovascular disease or stroke, stomach or duodenum ulcer, liver or gall diseases, kidney or urinary tract diseases and musculoskeletal diseases). Then we calculated the total number of chronic conditions per respondent. In a first step we calculated the percentage of respondents reporting two or more of these chronic conditions and, in a second step, the percentage of respondents reporting at least one chronic condition was calculated as well. The rationale behind performing a second step analysis for the indicator 'number of chronic conditions' (as well as for the indicator 'perceived general health') was to evaluate the results based on the first step.

Absolute as well as relative health differences between low and high SES groups were calculated. The absolute health difference (RD) was calculated as the morbidity rate in the low SES group minus the morbidity rate in the high SES group, controlling for age by indirect standardisation. The relative difference was calculated with logistic regression analyses using the high SES group as a reference. A nominal variable representing 5 year age groups was included in the regression model in order to correct for age. The regression coefficients and their standard errors were used to calculate odds ratios and their 95% confidence intervals. Income inequalities were mainly assessed by the Gini concentration index, a standard tool in income economics. The Gini index can range from 0 (equal income distribution) to 1 (maximum income concentration). As we know very little about the statistical distribution in the population, a non-parametric method (bootstrap resampling with 1,000 resamplings) was used to calculate 95% confidence intervals.

RESULTS

The median equivalent incomes per income decile for West and East Germany are shown in figure 1. They indicate that, for both males and females, income inequality is considerably larger in West Germany as compared to East Germany. This result was confirmed by the Gini concentration indices. The calculations yielded a Gini index of 0.218 for East Germany and 0.269 for West Germany. The 95% confidence intervals were 0.205–0.220 for East Germany and 0.262–0.273 for West Germany, indicating that income inequalities were significantly higher in West Germany than in East Germany. Concerning the distribution of the population over different educational levels, the socioeconomic differences in West and East Germany were remarkably similar (data not shown).

As expected, the prevalence rates for the morbidity indicators 'less than good or poor health' on one hand and 'two or more chronic conditions' on the other increased with age for males and females in both parts of Germany (figure 2a and b). It is also important to note that, with increasing age, the indicator 'two or more chronic conditions' rose much faster than the indicator 'less than good or poor health', but the most interesting point here is that

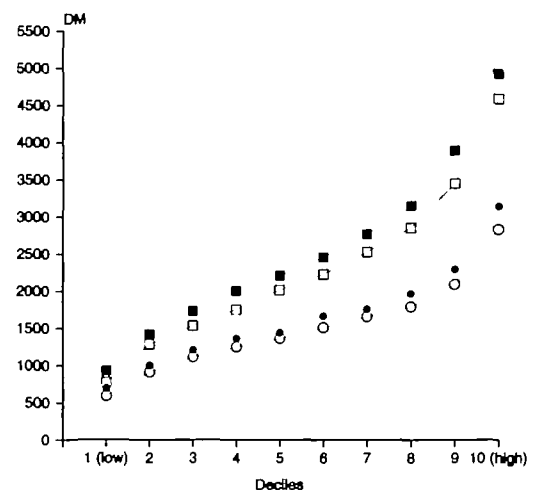


Figure 1 Income distribution: males in West Germany (filled squares), males in East Germany (filled circles), females in West Germany (open squares) and females in East Germany (open circles)

there do not seem to be important differences in morbidity between East and West Germany.

The rate differences and odds ratios comparing the income deciles 1 + 2 versus 9 + 10 on one hand and 1–5 versus 6–10 on the other are presented in table 1. For both morbidity indicators in both parts of Germany and for males as well as for females the odds ratios indicated health inequalities favouring the higher income groups. All odds ratios for the indicator 'less than good or poor health' reached statistical significance and, for West Germany, three out of four odds ratios for the indicator 'two or more chronic conditions' reached statistical significance as well (statistical significance was narrowly missed for the fourth odds ratio). It is also interesting to note that, at least in West Germany, health inequalities seemed to be larger for males than for females.

Concerning rate differences, in 15 out of 16 comparisons the morbidity rates were higher in the lower income groups as compared with the higher income groups. The odds ratios and rate differences suggested that, in East Germany, there were no substantial health inequalities by income as far as the indicator 'two or more chronic conditions' was concerned.

A mixed picture emerged when the extent of health inequalities was compared between East and West Germany. The rate differences and odds ratios suggested that, for the indicator 'two or more chronic conditions', health inequalities were larger in the West than in the East, but the confidence intervals overlapped widely, indicating that no statistically significant differences existed. For the indicator 'less than good or poor health' there did not seem to be a clear East–West pattern.

Concerning educational differences, the prevalence of 'less than good or poor health' increased with decreasing educational level in both parts of Germany, for males as well as for females (data not shown). The same association was shown for the indicator 'two or more chronic

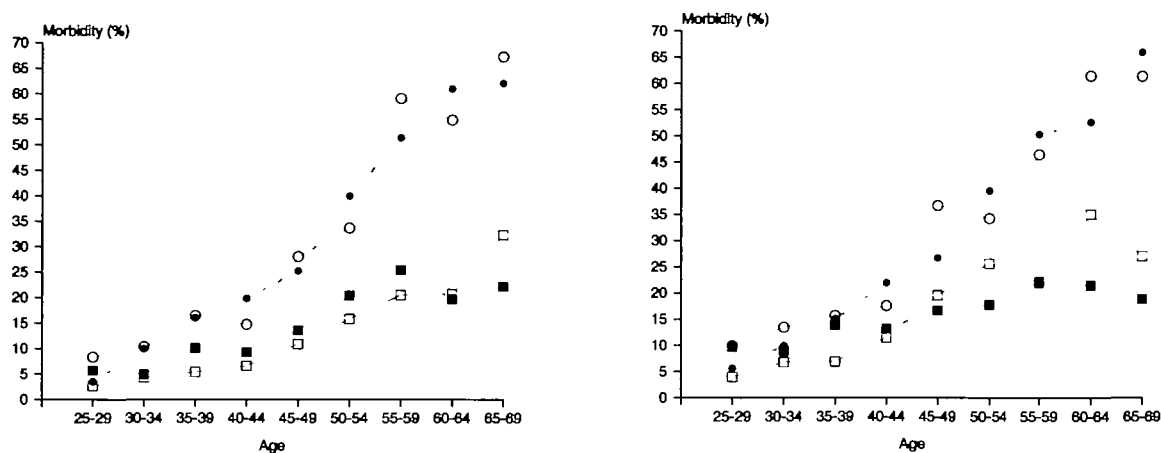


Figure 2 Morbidity by age a) in males (left side) and b) in females (right side)
Less than good or poor health in West Germany (filled squares) and East Germany (open squares) and two or more chronic conditions in West Germany (filled circles) and East Germany (open circles)

conditions', the only exception being females in East Germany. This result was supported by the rate differences and odds ratios (table 2). They indicated health inequalities favouring the higher educational level, the only exception being the indicator 'two or more chronic conditions' for females in East Germany. Again, a mixed picture emerged when the extent of health inequalities was compared between East and West Germany. The rate differences and the odds ratios for the indicator 'less than good or poor health' suggested that, for women, health inequalities were somewhat larger in the West than in the East, and the indicator 'two or more

chronic conditions' suggested that health inequalities were somewhat larger for men in the East than for men in the West. The most striking impression, though, is that there did not seem to be substantial differences in the extent of health inequalities between both parts of Germany. As outlined above, we calculated two more morbidity indicators in another step, i.e. 'satisfactory, less than good or poor health' (instead of 'less than good or poor health' only) and 'one or more chronic condition' (instead of 'two or more chronic conditions'). Of course, these additional morbidity indicators (results not shown) provide for

Table 1 Rate differences and odds ratios by income

Comparison of income deciles ^a	West Germany		East Germany	
	Less than good or poor health	Two or more chronic conditions	Less than good or poor health	Two or more chronic conditions
Males				
1+2 / 9+10				
Rate difference (%)	13.5	7.0	11.8	3.2
Odds ratio	3.28	1.54	4.05	1.43
(95% CI)	(2.28–4.73)	(1.14–2.07)	(1.91–8.62)	(0.86–2.38)
1–5 / 6–10				
Rate difference (%)	6.9	4.2	3.5	–0.7
Odds ratio	1.92	1.30	1.51	1.03
(95% CI)	(1.51–2.44)	(1.07–1.59)	(1.01–2.27)	(0.75–1.42)
Females				
1+2 / 9+10				
Rate difference (%)	9.1	5.2	7.5	0.6
Odds ratio	2.08	1.41	1.93	1.08
(95% CI)	(1.49–2.90)	(1.05–1.89)	(1.06–3.50)	(0.67–1.74)
1–5 / 6–10				
Rate difference (%)	4.0	2.4	8.2	1.3
Odds ratio	1.38	1.17	1.99	1.11
(95% CI)	(1.10–1.72)	(0.96–1.42)	(1.39–2.85)	(0.82–1.50)

a: 1+2 / 9+10: income deciles 1+2 versus income deciles 9+10
1–5 / 6–10: income deciles 1–5 versus income deciles 6–10

higher prevalences and narrower confidence intervals than the results based on a more restricted definition of morbidity. Concerning the comparison of health inequalities between East and West Germany, though, these additional morbidity indicators supported the impression that there were no significant differences in health inequalities between East and West Germany. Looking at health inequalities by income, for example, the inequalities assessed by the indicator 'satisfactory, less than good or poor health' were somewhat larger in the West than in the East, and the inequalities assessed by the indicator 'one or more chronic condition' were somewhat larger in the East than in the West, but the differences between East and West Germany never reached statistical significance.

DISCUSSION

One important methodological shortcoming of this study was the different reference periods for the question on chronic diseases (West Germany lifetime prevalence; and East Germany previous 12 months). There was, therefore, a bias comparing the prevalence rates between East and West Germany (*figure 2a and b*), but we do not expect a major bias for the comparison on health inequalities. Overall, we put some trust in our results, as the comparison was based on two rather large representative samples and the study protocol was nearly identical in both surveys. In addition, there was little reason to believe that potential selection biases or recall biases differed between East and West Germany. Additional sensitivity analyses showed that the inequality estimates were not very sensitive to the exact values used to estimate the incomes of the lowest and highest income classes.

The three questions asked above can be answered in the following way. There were substantial differences in social inequalities between East and West Germany if income was considered. *Figure 1* and the Gini concentration indices indicate that income inequality was significantly larger in the West than in the East. The Ginis reported above and their differences between East and West Germany are similar to previously published Ginis based on comparable data and equalisation schemes.²⁴ However, there were minor differences if educational status was used as an indicator for social status. Concerning the

question about differences in morbidity between East and West Germany, *figure 2a and b* indicates that there are no major differences.

The main question concerning differences in health inequalities between East and West Germany is more difficult to answer. It could be stressed that some differences were found and that most differences pointed towards larger health inequalities in the West than in the East, particularly when health inequalities by income were considered. However, it is more important to note that the differences in health inequalities were neither consistent for both indicators of morbidity nor statistically significant. Contrary to our hypothesis that health inequalities are larger in West Germany than in East Germany, the results presented here suggest that there are no consistent or significant differences in health inequalities between both parts of Germany. This also seems to be true for health inequalities by income, despite the fact that income inequality was considerably larger in the West than in the East. These results can hardly be the basis for policy recommendations, though, as they are based on cross-sectional data. In a next step we would need longitudinal data assessing simultaneous changes in income inequalities and health inequalities.

The present study focused on the period shortly after the unification of Germany. The interpretation of the results is complicated by the fact that the effects of the political and economic system before the unification are mixed with the effects of the unification itself (i.e. economic disturbances and social stress in East Germany, selective migration to the West, etc.). Social systems and health inequalities probably do not change rapidly and, as the data were based on surveys conducted only 2 years after the unification, they probably to a large extent still expressed differences between a socialist and a capitalist society. An obvious expression of this difference is that the income inequalities in 1990–1992 were still considerably smaller in the East than in the West.

Large studies which have compared many different Western European countries have observed that the extent of health inequalities seems to be somewhat unrelated to the size of income inequalities or, more generally, to the type of socioeconomic policies.^{2,5} The comparison between East and West Germany brings

Table 2 Rate differences and odds ratios by educational levels

Comparison of educational levels ^a	West Germany		East Germany	
	Less than good or poor health	Two or more chronic conditions	Less than good or poor health	Two or more chronic conditions
Males				
Rate difference (%)	4.6	3.3	4.1	6.3
Odds ratio	1.51	1.23	1.63	1.29
(95% CI)	(1.19–1.90)	(1.01–1.50)	(1.07–2.49)	(0.91–1.81)
Females				
Rate difference (%)	5.6	1.3	2.2	–0.9
Odds ratio	1.64	1.09	1.24	0.94
(95% CI)	(1.30–2.05)	(0.89–1.33)	(0.85–1.82)	(0.66–1.32)

a: Lower level versus medium plus higher level

important additional evidence supporting this observation because it compares two countries which are highly similar in many other aspects, thus avoiding some problems of confounding which may have strongly affected other international comparisons and also because the data are more comparable than in any other international comparison.

This study was based on the concerted action 'Socio-economic Inequalities in Morbidity and Mortality in Europe' (director, Professor Johan Mackenbach, Erasmus University, Rotterdam) which was funded by the European Union.

REFERENCES

- 1 Van Doorslaer E, Wagstaff A, Bleichrodt H, et al. Income-related inequalities in health: some international comparisons. *J Health Econ* 1997;16:93-112.
- 2 Mackenbach J, Kunst A, Cavelaars A, Groenhoff F, Geurts J, EU Working Group on Socio-economic Inequalities in Health. Socioeconomic inequalities in morbidity and mortality in Western Europe. *Lancet* 1997;349:1655-9.
- 3 Cavelaars A, Kunst A, Geurts J, et al. Morbidity differences by occupational class among men in seven European countries: an application of the Erikson-Goldthorpe social class scheme. *Int J Epidemiol* 1998;27:222-30.
- 4 Cavelaars A, Kunst A, Geurts J, et al. Differences in self reported morbidity by educational level: a comparison of 11 Western European countries. *J Epidemiol Commun Health* 1998;52:219-27.
- 5 Kunst AE. Cross-national comparisons of socio-economic differences in mortality (dissertation). Rotterdam: Erasmus University, 1997.
- 6 Helmert U, Shea S. Social inequalities and health status in Western Germany. *Public Health* 1994;108:341-56.
- 7 Kirchgässler KU. Health and social inequities in the Federal Republic of Germany. *Soc Sci Med* 1990;31:249-56.
- 8 Mielck A, editor. Krankheit und soziale Ungleichheit: Ergebnisse der sozial-epidemiologischen Forschung in Deutschland. Opladen: Leske & Budrich, 1994.
- 9 Kunzendorff E. Soziale Differenzierung in epidemiologischen und medizin-soziologischen Untersuchungen auf dem Gebiet der DDR. Gab es soziale Ungleichheit als medizinisch relevantes Problem? In: Mielck A, editor. Krankheit und soziale Ungleichheit. Opladen: Leske & Budrich, 1994:53-92.
- 10 Mielck A, Apelt P. Krankheit und Soziale Ungleichheit in der DDR: das Beispiel Görlitz. In: Mielck A, editor. Krankheit und soziale Ungleichheit. Opladen: Leske & Budrich, 1994:243-52.
- 11 Niehoff JU, Schneider F. Sozialepidemiologie in der DDR: Probleme und Fakten. *Jahrbuch für Kritische Medizin* 1991;16:53-83.
- 12 Mielck A, Apelt P. Comparing health inequalities between East and West Germany. In: Levy É, Mizrahi A, editors. From economic analysis to health policy. Proceedings of the Fourth European Health Services Research Meeting. Paris: University Dauphine, 1993:145-51.
- 13 Lüschen G, Niemann S, Apelt P. The integration of two health systems: social stratification, work and health in East and West Germany. *Soc Sci Med* 1997;44:883-99.
- 14 Lüschen G, Geling O, Janßen C, Kunz G, von dem Knesebeck O. After unification: gender and subjective health status in East and West Germany. *Soc Sci Med* 1997;44:1313-23.
- 15 Winkelhake O, Mielck A, John J. Einkommen, Gesundheit und Inanspruchnahme des Gesundheitswesens in Deutschland 1992. *Sozial- und Präventivmedizin* 1997;42:3-10.
- 16 Hauser R. Armutsberichterstattung. In: Noll HH, editor. Sozialberichterstattung in Deutschland. Weinheim/München: Juventa Verlag, 1997:19-45.
- 17 Robert-Koch-Institut, editor. Die Gesundheit der Deutschen. ein Ost-West-Vergleich von Gesundheitsdaten. Berlin: RKI-Heft 7/1995, 1995.
- 18 Bundesminister für Gesundheit, editor. Daten des Gesundheitswesens. Ausgabe 1995. Baden-Baden: Nomos Verlagsgesellschaft, 1995.
- 19 Mielck A. Mortalität und Lebenserwartung: Unterschiede zwischen Ost- und Westdeutschland. *Sozialer Fortschritt* 1991;40:220-3.
- 20 GCP Study Group. The German Cardiovascular Prevention Study (GCP): design and methods. *Eur Heart J* 1988;9:1058-66.
- 21 Hoffmeister H, Hoeltz J, Schoen D, Schroeder E, Guether B. Nationaler Untersuchungssurvey und regionale Untersuchungssurveys der DHP. *DHP-Forum* 1988:1-59.
- 22 Heinemann L, editor. MONICA Ostdeutschland Datenbuch 1984-1989 (MONICA East Germany data book). Vol. 1. Berlin/Zwickau, 1992.
- 23 Buhmann B, Rainwater L, Schmaus G, Smeeding TM. Equivalence scales, well-being, inequality, and poverty: sensitivity estimates across ten countries using the Luxembourg Income Study (LIS) data base. *Rev Income Wealth* 1988;2:115-42.
- 24 Weick S. Unerwartet geringe Zunahme der Einkommensungleichheit in Ostdeutschland. *Informationsdienst Soziale Indikatoren* 1995;14:6-9.

Received 4 June 1998, accepted 21 March 2000