The contribution of medical care to changing life expectancy in Germany and Poland

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Abstract

This paper assesses the impact of medical care on changes in mortality in east Germany and Poland before and after the political transition, with west Germany included for comparison. Building upon *Rutstein's* concept of unnecessary untimely deaths, we calculated the contribution of conditions considered responsive to medical care or health policy to changes in life expectancy between birth and age 75 $[e_{(0-75)}]$ for the periods 1980/1983–1988 and 1991/1992–1996/1997.

Temporary life expectancy, between birth and age 75, has been consistently higher in west Germany, intermediate in east Germany and lowest in Poland. Although improving in all three regions between the early 1980s and the late 1990s, the pace of change differed between countries, resulting in a temporary widening of an initial east–west gap by the late 1980s and early 1990s. In the 1980s, in east Germany, 50–60% of the improvement was attributable to declining mortality from conditions responsive to medical care (west Germany: 30–40%). A net positive effect was also observed in Poland, although counterbalanced by deterioration in ischaemic heart disease mortality.

In the former communist countries, improvements attributable to medical care in the 1980s were due, largely, to declining infant mortality. In the 1990s, they benefited also adults, specifically those aged 35+ in Poland and 55+ in Germany. A persisting east–west gap in temporary life expectancy in Germany was due, largely, to higher mortality from avoidable conditions in the east, with causes responsive to health policy contributing about half, and medical care 16% (men) to 24% (women) to the differential in 1997.

The findings indicate that changes in the health care system related to the political transition were associated with improvements in life expectancy in east Germany and, to a lesser extent, in Poland. Also, differences in the quality of medical care as assessed by the concept of 'unnecessary untimely deaths' appear to contribute to a persisting east–west health gap. Especially in Poland and the former German Democratic Republic there remains potential for further progress that would narrow the health gap with the west. © 2002 Elsevier Science Ltd. All rights reserved.

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Introduction

During the 1980s the health of the peoples of central and eastern Europe lagged increasingly far behind that of their western neighbours. In some countries, such as the German Democratic Republic (GDR), this was due to a failure to achieve the improvements in adult mortality seen in the west (Nolte, Shkolnikov, & McKee, 2000a). In others, such as Poland, there was an actual increase in adult mortality. The political transition in the early 1990s also had a considerable impact on health although, again, there were both similarities and differences. A short-lived worsening in mortality in all countries was followed by improvements in health, which were rapid in some countries and delayed in others (Zatoñski & Boyle, 1996; McKee & Zatoñski, 1998).

The former GDR offers unique opportunities to understand these changes. During the 1980s its level of

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mortality lay in an intermediate position between east and west. After the fall of the Berlin Wall its experience of transition was also unusual, with rapid progress to unification with the Federal Republic of Germany (FRG), with the accompanying transformation of institutions supported by a massive injection of funds. This experience was very different from those of its eastern neighbours. This paper focuses on the improvement in mortality in the former GDR (hereafter described as east Germany) and in Poland. East Germany experienced an increase in life expectancy at birth of 2.4 years in men and 2.3 years in women between 1992 and 1997 (Nolte, Shkolnikov, & McKee, 2000b). Poland experienced an increase of 2 years in life expectancy at birth among men and 1.2 years among women between 1991 and 1996.

There are many possible causes for the mortality decline. They could be the effect of existing historical trends, reflecting the impact of factors acting in childhood on those who are now adults (Davey Smith, Hart, Blane, & Hole, 1998). They could also reflect contemporary factors, such as changes in diet, and thus in the risk of heart disease, as has been suggested for Poland and the Czech Republic (Zatoñski & Boyle, 1996; Bobak, Skodova, Pisa, Poledne, & Marmot, 1997).

One factor that has received less attention is improved medical care, an exception being the suggestion that it was a major contributor to the accelerated post-unification mortality decline amongst the oldest-old in east Germany (Gjonça, Brockmann, & Maier, 1999). Again, the experience of east Germany was unique among the former communist states. Its health care sector was rebuilt after unification with, for example, an investment of DM 21 billion (*12.5 billion) between 1995 and 2004 in the hospital sector (Bundesministerium für Gesundheit, 1998). Modern pharmaceuticals, considered the major explanation for the subsequent decline in deaths from testicular cancer, became available (Becker & Boyle, 1997). Improvements in neonatal mortality in east Germany have also been attributed, in part, to improvements in the quality of perinatal care (Nolte, Brand, Koupilová, & McKee, 2000c), although this has also been noted in the Czech Republic (Koupilová, McKee, & Holčik, 1998). Poland, on the other hand, is more typical of the former communist countries. Although it too has experienced an improvement in mortality, the possible impact of health care is generally considered small as reform of the system has been somewhat slower (Cockerham, 1999; European Observatory on Health Care Systems, 1999). Thus, a comparison of east and west Germany and Poland offers a valuable opportunity to explore the potential role of the health care system in the recent fall in mortality.

Building upon the concept of 'unnecessary untimely deaths' ('avoidable' mortality) originally introduced by Rutstein and co-workers in the 1970s as a measure of the quality of medical care (Rutstein et al., 1976), this study seeks to quantify the contribution of medical care to changes in mortality in east and west Germany and Poland. To assess the potential impact of medical care, we examine trends in the 1980s, when life expectancy at birth in east Germany and Poland improved only little or even stagnated (Nolte et al., 2000a), and in the 1990s, a period of sustained improvement in mortality in both regions.

Methods

Data

Mortality data for the two parts of Germany for 1980–1997 were obtained from the Statistical Office Germany (Statistisches Bundesamt, 1980–1997) and those for Poland from the WHO mortality files (1980–1996) (WHO, 2000). Data include deaths in each year, using the 9th revision of the International Classification of Diseases (ICD) (WHO: abbreviated list; Statistical Office: 3-digit code (1980–1989) and detailed list (1990–1997)), by sex and 5-year age band (with infant deaths listed separately). Population numbers by sex and age were obtained from the same sources.

This study makes use of reconstructed mortality data from the former GDR for 1980–1989. It is known that published data on causes of death in the GDR were not complete between 1975 and 1988 (Nolte et al., 2000a) as deaths from some violent and alcohol-related causes were not reported for political reasons (Höhn & Pollard, 1991) but were combined with ill-defined causes to maintain total all cause mortality. After unification, the GDR mortality data for 1980 to 1989 were reconstructed, which included an extraction of formerly 'hidden' causes of death (e.g. liver cirrhosis, suicide, homicide) (Statistisches Bundesamt, 1995), thus making it possible to study mortality patterns in the 1980s in the former GDR in more detail than has previously been possible (Höhn & Pollard, 1991; McKee et al., 1996; Nolte et al., 2000a).

Selection of causes of death

The selection of causes of death considered 'avoidable' was essentially based on the lists proposed by Mackenbach, Looman, Kunst, Habbema, and van der Maas (1988) and Holland (1988, 1991, 1993, 1997), separating causes responsive to medical intervention from those responsive to inter-sectoral health policies (Albert, Bayo, Alfonso, Cortina & Corella, 1996). The conditions selected in our study were considered either indicators for the impact of medical care, i.e. secondary prevention or medical treatment, thus 'amenable' or 'treatable' conditions, or of health policy, i.e. primary

prevention, thus 'preventable' conditions. They were not intended to cover all causes possibly preventable and/or treatable. Rather, it was assumed that while not all deaths from these causes would be 'avoidable', health services could contribute substantially to minimising mortality. Conditions considered responsive to medical care or health policy used in this study are shown in Table 1.

To calculate the contribution of 'avoidable' conditions to changes in life expectancy, single causes and cause groups were combined. Ischaemic heart disease (IHD) was treated separately as (1) the precise contribution of medical care to reductions in deaths from this condition is unresolved (Tunstall-Pedoe et al., 2000), (2) IHD may be understood as an indicator of medical care but also for health policy, and (3) the large

number of deaths involved is likely to conceal the impact of medical care on diseases other than IHD. Four cause groups were analysed: conditions responsive to health policy, conditions responsive to medical care, IHD, and non-avoidable causes, comprising the remaining causes of death (Table 1).

As in the work of Mackenbach and co-workers (1988), an age-limit was set at 75 years as 'avoidability' of death and reliability of death certification become increasingly questionable at older ages. Different age limits were set for diabetes mellitus (<50) because the avoidability of deaths at older ages from diabetes, and in particular the effectiveness of good diabetic control in reducing vascular complications, remain controversial; and, at ages <15, because intestinal infectious diseases, whooping cough, measles and childhood respiratory

Table 1
Groups of causes of death used in the study

Cause of death	ICD 9	Age group
Causes responsive to medical care		
Intestinal infections	001–009	0–14
Tuberculosis	010–018, 137	0–74
Other infectious (diphteria, tetanus, poliomyelitis, osteomyelitis)	032, 037, 045, 730	0–74
Whooping cough	033	0–14
Septicemia	038	0–74
Measles	055	1–14
Malignant neoplasm of skin	173	0–74
Malignant neoplasm of breast	174	0–74
Malignant neoplasm of cervix uteri	180	0–74
Malignant neoplasm of testis	186	0–74
Hodgkin's disease	201	0–74
Leukaemia	204–208	<15
Diseases of the thyroid	240–246	0–74
Diabetes mellitus	250	0–49
Rheumatic heart disease	393–398	0–74
Hypertensive disease	401–405	0–74
Cerebrovascular disease	430–438	0–74
All respiratory diseases (excluding pneumonia/influenza)	460–479, 488–519	1–14
Pneumonia/influenza	480–487	0–74
Peptic ulcer	531–533	0–74
Appendicitis	540–543	0–74
Abdominal hernia	550–553	0–74
Cholelithiasis (& cholecystitis)[a]	574–575.1	0–74
Nephritis and nephrosis	580–589	0–74
Benign prostatic hyperplasia	600	0–74
Maternal deaths	630–676	All ages
Congenital cardiovascular anomalies	745–747	0–74
Perinatal deaths, all causes excluding stillbirths	760–779	All ages
Ischaemic heart disease	410–414	0–74
Causes responsive to health policy		
Malignant neoplasm of trachea, bronchus, and lung	162	0–74
Cirrhosis of liver	571	0–74
Motor vehicle accidents	E810–825	All ages

[a] Cholecystitis not included in 1980/1988 data for Germany as only 3-digit codes of ICD-9 were available.

diseases (as deaths other than in childhood from these causes are likely to reflect some other disease process) as well as leukaemia, which involves different group of diseases in children and in adults.

Analyses

The contribution of medical care to changes in mortality trends in Germany and Poland was estimated by decomposing life expectancy by age and cause of death. This enables separation of differences between life expectancies into contributions according to age and cause of death, expressed in years gained or lost. Because of the age limit noted earlier, the analyses were based on temporary life expectancy between birth and age 75 [$e_{(0-75)}$] rather than life expectancy at birth.[1] Life expectancy was calculated using standard life table techniques (Chiang, 1984). Decomposition of differences in life expectancy was undertaken using methods developed independently by Andreev (1983), Arriaga (1984), and Pressat (1985). Analyses used Microsoft Excel.

To examine mortality in the two parts of Germany and Poland, the period 1980–1988 was chosen to assess changes before transition. For Poland, data on external causes were only available from 1983. The period under investigation was therefore 1983–1988. To enable comparisons in the years after transition, a 6-year period was chosen for each region. Changing coding procedures in the former GDR in October 1990 (Brückner, 1993) may have implications for comparability of data in 1990 and 1991, so the year 1992 was taken as baseline for the two parts of Germany, with analyses extending to 1997. Mortality data for Poland were only available to 1996, so there the period of analysis was 1991–1996.

Age-standardised mortality rates by sex were calculated for all conditions and for all ages (0–74) by direct standardisation to the European standard population (Waterhouse, Muir, Correa, & Powell, 1976).

Throughout this paper, *east Germany* refers to the territory of the former GDR before unification, including east Berlin. *West Germany* refers to the territory of

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[1] The term "temporary life expectancy" was introduced by E. Arriaga who was among the first to develop this indicator (Arriaga, 1984). The expression is also used by J.H. Pollard (1988) who developed a similar methodological approach (Demography 25, 265–276) as well as by Velkova et al. (1997) who address a topic similar to ours. Others may be more familiar with the alternative expression "partial life expectancy", which has been used specifically in the context of 'healthy life expectancy' (e.g. Graham & Davis (1990). Community Health Studies 14, 138–145; Sihvonen, Kunst, Lahelma, Valkonen, & Mackenbach (1998). Social Science & Medicine 47, 303–315).

the Federal Republic (FRG) before unification, including west Berlin.

Results

Trends in temporary life expectancy

Temporary life expectancy, between birth and age 75, was consistently higher in west Germany, intermediate in east Germany and lowest in Poland (Table 2). Although improving in all three regions between the early 1980s and the late 1990s, the pace of change differed between countries, resulting in a temporary widening of an initial east–west gap by the late 1980s and early 1990s. By 1997 the east–west gap in Germany had almost disappeared for women, falling from 0.8 to 0.2 years, and, for men, had narrowed substantially from 2 to 1.3 years. Poland continued to lag behind both parts of Germany.

These figures do, of course, relate only to deaths under 75, so it is important to note that, in the 1990s, they contributed only about 40% of the total improvement in female life expectancy at birth in both parts of Germany. The contribution in Poland and among men everywhere was over 50% (data not shown).

Mortality patterns in the 1980s

Fig. 1 shows how different causes of death contributed to changes in temporary life expectancy in each country between 1980/1983 and 1988. The sum of values, negative and positive, represents the change in life expectancy between birth and age 75 in years (delta $e_{(0-75)}$). Bars extending below the horizontal axis indicate that mortality rates in the age group concerned actually increased and thus contributed negatively to the overall change in temporary life expectancy, while bars above the axis indicate that mortality rates in an age group fell and therefore contributed positively.

In all countries, improvements in mortality from conditions amenable to medical care made substantial positive contributions to the overall change in life expectancy. In Poland, more than two thirds of this improvement was due to a decline in infant mortality, as in east German men, whereas among east German women and in west Germany declining mortality among those aged 45+ was also important. In the west, this was largely driven by improvements in mortality from hypertensive and cerebrovascular disease, while in east German women declining mortality from these causes among those aged 45–64 was nearly counteracted by a parallel increase among those aged 65+ (data not shown).

If IHD was to be included with amenable conditions, their impact on life expectancy would be even higher in

Table 2
Life expectancy between birth and age 75 in east and west Germany and Poland since 1980 (in years)

Country	Life expectancy between birth and age 75			
	1980/1983[a]	1988	1991/1992[b]	1996/1997[c]
	Males			
E. Germany	65.90	66.61	66.45	67.86
W. Germany	66.43	68.04	68.50	69.12
Poland	64.13	64.29	63.50	64.84
	Females			
E. Germany	69.57	70.27	70.64	71.55
W. Germany	70.14	71.18	71.47	71.78
Poland	69.28	69.59	69.49	70.19

[a] East and west Germany: 1980, Poland: 1983.
[b] Poland: 1991, east and west Germany: 1992.
[c] Poland: 1996, east and west Germany: 1997.

west Germany, contributing 0.83 of a year in men and 0.49 of a year in women (Table 3). It would, however, remain largely unchanged in the former GDR, and actually be somewhat lower in Poland.

Declining mortality from conditions responsive to broader health policy measures had a noticeable impact in west Germany only, with one third being attributable to falling death rates among those aged 15–24 years. Much of the improvement was due to fewer deaths from motor vehicle accidents and liver cirrhosis (Table 4). In the two other countries, declining mortality from preventable conditions was also apparent at younger ages but counterbalanced by an actual increase among the middle aged, largely reflecting increasing death rates from liver cirrhosis, and in Poland also from lung cancer. A similar pattern was observed for women, although the overall impact of health policy was less visible or even slightly adverse in east Germany.

Mortality patterns in the 1990s

Fig. 2 shows the contribution of deaths, at different ages and from different causes, to changes in temporary life expectancy between 1991/1992 and 1996/1997. In all three regions, changes in amenable causes made a somewhat smaller contribution to the changes in life expectancy than they had in the 1980s. If the fall in mortality from IHD is added, however, the relative impact of reduced mortality from amenable conditions in men increases in both parts of Germany and Poland.

Among women, falling death rates from amenable conditions accounted for at least 25% of the overall increase in temporary life expectancy, at 0.2 of a year in east Germany, 0.1 in west Germany, and 0.2 in Poland. Apart from declining infant mortality, falling death rates from hypertension and cerebrovascular diseases

and from cervical cancer and breast cancer have been important contributors.

In east and west Germany, improvements attributable to declining mortality from amenable conditions and IHD were largely confined to infants and those aged 55+, while in Poland improving mortality at younger ages (35+) was also important, contributing over half of the overall increase in temporary life expectancy.

In contrast, conditions responsive to broader health policy measures were more important, in relative terms, for improvements in temporary life expectancy in men (Table 3). In both east Germany and Poland this was almost entirely due to declining mortality among those aged 20–59 years, largely attributable to fewer deaths from motor vehicle accidents, and, in east Germany, also liver cirrhosis (Table 4). In women, the impact of falling death rates from preventable conditions was less visible.

East–west gap in temporary life expectancy

Although the greater improvement in temporary life expectancy in the east has narrowed the gap between the two parts of Germany, there are still important differences, at least in men. Fig. 3 examines the components of this gap in 1992 and 1997. Bars extending below the horizontal axis indicate that death rates in the age group concerned advantage the eastern part while bars above the axis indicate an advantage to the west.

In 1992, deaths at all ages were higher in east Germany in both sexes, but particularly in men aged 15+ and women aged 55+. In men, much of the east–west mortality differential was attributable to preventable conditions, accounting for 0.8 of a year of the overall gap in temporary life expectancy, at 2.1 years,
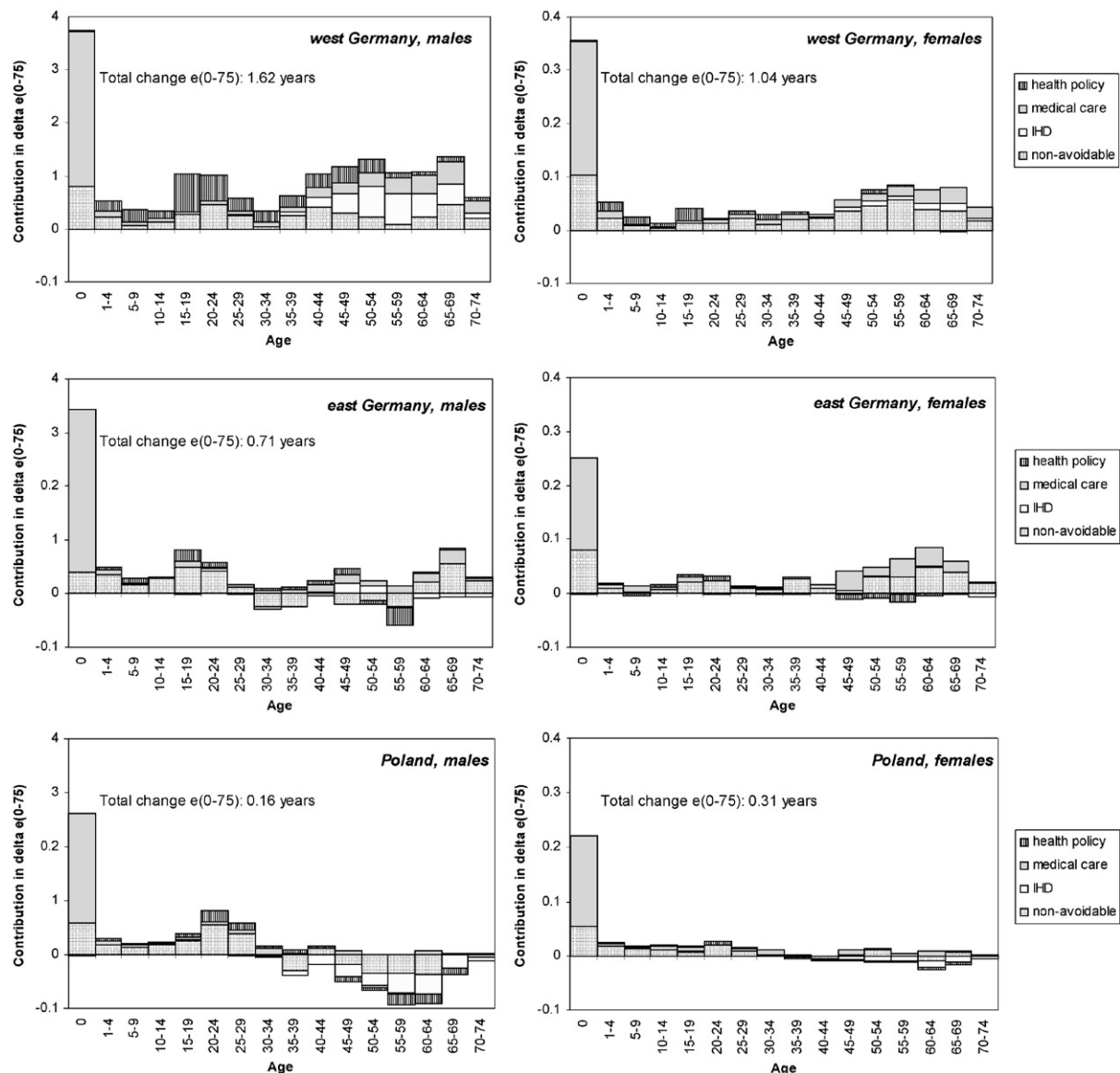
Fig. 1. Age- and cause specific contributions to changes in life expectancy in east and west Germany and Poland: 1980/1983–1988.

reflecting higher mortality from motor vehicle accidents at younger ages and from liver cirrhosis among the middle-aged. Amenable conditions were least important in shaping the east–west mortality differential in men, accounting for 0.3 of a year, while higher mortality from IHD in the east contributed 0.4 of a year.

By 1997, the east–west gap in life expectancy in men had narrowed considerably, but still was largely attributable to preventable conditions, accounting for 0.6 years of the remaining differential of 1.3 years. Interestingly, though, the relative contribution of higher mortality from amenable conditions and from IHD

remained largely unchanged, contributing about 16% to 20%.

Among women, an overall east–west gap in temporary life expectancy of 0.8 years in 1992 was largely attributable to non-avoidable conditions, at 0.3 years, with higher mortality from amenable conditions coming a close second, at 0.2. Higher mortality from IHD accounted for another one fifth of the gap, as did higher death rates from preventable conditions. Unlike with men, the gap attributable to preventable conditions in 1992 was largely confined to younger age groups.

Table 3
Cause specific contribution to changes in temporary life expectancy (e_{0-75}), in years by cause group in east and west Germany and Poland: 1980/1983–1988 and 1991/1992–1996/1997

	Contribution in years to changes in life expectancy (0–75)		
	W. Germany	E. Germany	Poland
1980/1983–1988[a], males			
Conditions responsive to health policy measures	0.351	0.040	0.004
Conditions responsive to medical care	0.554	0.445	0.260
IHD	0.274	0.013	−0.179
Non-avoidable conditions	0.440	0.216	0.075
Total	1.618	0.714	0.161
1980/1983–1988[a], females			
Conditions responsive to health policy measures	0.086	−0.020	0.004
Conditions responsive to medical care	0.434	0.349	0.227
IHD	0.053	0.003	−0.060
Non- avoidable conditions	0.468	0.364	0.140
Total	1.042	0.696	0.311
1991/1992–1996/1997[b,c], males			
Conditions responsive to health policy measures	0.102	0.319	0.233
Conditions responsive to medical care	0.076	0.200	0.308
IHD	0.129	0.245	0.351
Non-avoidable conditions	0.322	0.641	0.576
Total	0.628	1.406	1.468
1991/1992–1996/1997[b,c], females			
Conditions responsive to health policy measures	0.025	0.081	0.018
Conditions responsive to medical care	0.080	0.244	0.222
IHD	0.022	0.092	0.092
Non-avoidable conditions	0.186	0.492	0.370
Total	0.312	0.909	0.701

[a] East and west Germany: 1980, Poland: 1983.
[b] Poland: 1991, east and west Germany: 1992.
[c] Poland: 1996, east and west Germany: 1997.

By 1997, the east–west mortality differential among German women had almost disappeared. But as with men, the remaining gap of 0.2 years in temporary life expectancy was largely attributable to preventable conditions, contributing 50%. Higher mortality from amenable conditions and from IHD accounted for over 70% of a persisting mortality differential among those aged 55+ .

Discussion

Data quality

Changes in mortality patterns such as these raise questions about quality and completeness of data.

Problems arising from differences in the definition of live and stillbirths between the former GDR, Poland and the old FRG (Mugford, 1983; Gourbin & Masuy-Stroobant, 1995) are not expected to affect our results, as between-country comparisons were limited to east and west Germany after unification when the definition in place in the west had already been introduced in east Germany. Differences in defining residential population and estimating the population denominator, discussed in detail elsewhere (Zatoñski & Boyle, 1996; Nolte et al., 2000a), are not likely to have an effect on our results for the same reason.

One potential concern is a possible variation in coding of causes of death. These differed between the former GDR and the old FRG, but the western practice was adopted at unification. In Poland, coding practice

Table 4
Age standardised death rates (per 100,000) for selected causes and cause groups in east and west Germany and Poland: 1980/1983, 1988, 1991/1992 and 1996/1997: age 0–74

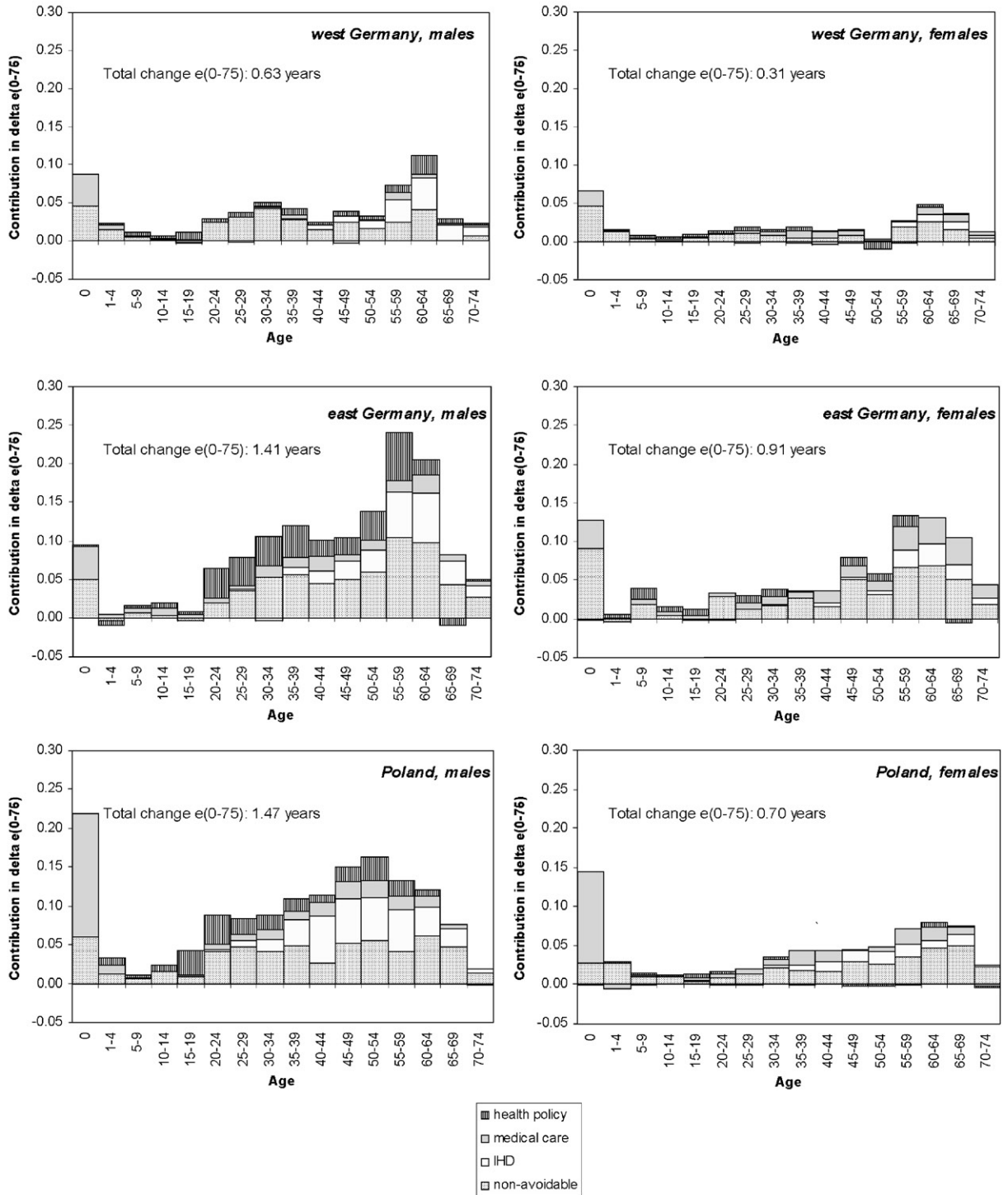|	West Germany				East Germany				Poland			
	1980	1988	1992	1997	1980	1988	1992	1997	1983	1988	1991	1996
Males												
Conditions responsive to health policy measures	118.7	98.0	92.2	84.1	102.6	102.6	140.0	120.0	119.1	125.9	146. 9	133.9
Lung cancer [ICD 162]	56.0	55.2	53.5	49.2	62.7	60.2	58.2	54.9	76.7	86.7	91.0	87.6
Liver cirrhosis [ICD 571]	35.2	26.3	24.0	22.2	22.2	26.8	50.5	42.4	15.0	15.5	18.1	18.8
Motor vehicle accidents [E810–825]	27.6	16.5	14.6	12.7	17.7	15.6	31.3	22.7	27.5	24.7	37.7	27.6
Conditions responsive to medical care	111.3	69.3	59.9	54.8	156.3	131.9	94.1	78.1	152.2	143.2	143.4	142.8
Malignant neoplasm of testis [ICD 186]	1.2	0.6	0.5	0.4	1.9	1.5	1.2	0.8	1.1	0.9	0.9	0.8
Hypertension & cerebrovascular disease [ICD 401–405; 430–438]	65.3	42.2	36.1	32.0	86.4	81.7	58.7	42.4	62.2	69	74.5	69.1
Ischaemic heart disease	164.5	132.0	111.7	94.0	131.9	135.1	163.0	130.2	126.8	151.7	167.4	130.2
Non-avoidable conditions	354.7	318.1	307.1	286.5	439.8	412.8	356.4	291.5	523.5	535.6	570.6	514.0
Total	749.3	617.3	570.9	519.4	830.6	782.3	753.4	619.8	921.6	956. 6	1027.7	904.0
Females												
Conditions responsive to health policy measures	27.2	25.0	25.7	25.1	17.8	20.9	33.2	30.0	20.7	21.9	26.8	26.1
Lung cancer [ICD 162]	6.4	8.8	10.3	11.9	5.8	7.3	7.7	9.2	9.1	11.4	12.4	13.7
Liver cirrhosis [ICD 571]	11.8	10.4	10.3	9.2	6.9	8.7	16.4	13.8	5.6	5.5	6.0	5.7
Motor vehicle accidents [E810–825]	9.0	5.8	5.1	4.0	5.2	4.8	9.1	7.0	6.1	5.0	8.5	6.7
Conditions responsive to medical care	100.3	74.5	66.6	60.9	136.4	117.5	88.8	66.8	131.6	123.7	118.3	108.5
Malignant neoplasm of female breast [ICD 174]	24.5	27.6	27.0	25.5	20.1	20.2	22.1	19.7	18.1	19.2	23.0	19.3
Malignant neoplasm of cervix uteri [ICD 180]	5.1	3.8	3.4	2.7	9.3	7.0	6.4	4.8	10.1	10.2	11.6	8.8
Hypertensive & cerebrovascular disease [ICD 401–405; 430–438]	41.9	26.1	21.9	19.1	64.8	58.7	38.9	26.4	48.1	49.4	48.3	46.1
Ischaemic heart disease	46.9	40.5	34.2	30.3	44.9	46.7	58.0	46.6	33.2	40.2	45.6	37.5
Non-avoidable conditions	199.9	167.0	155.1	143.5	259.3	229.2	182.6	144.6	253.6	249.5	250.5	216.5
Total	374.3	307.0	281.6	259.8	458.4	414.3	362. 7	288.0	439.1	435.3	441.2	388.6

Fig. 2. Age- and cause specific contributions to changes in life expectancy in east and west Germany and Poland: 1991/1992–1996/1997.
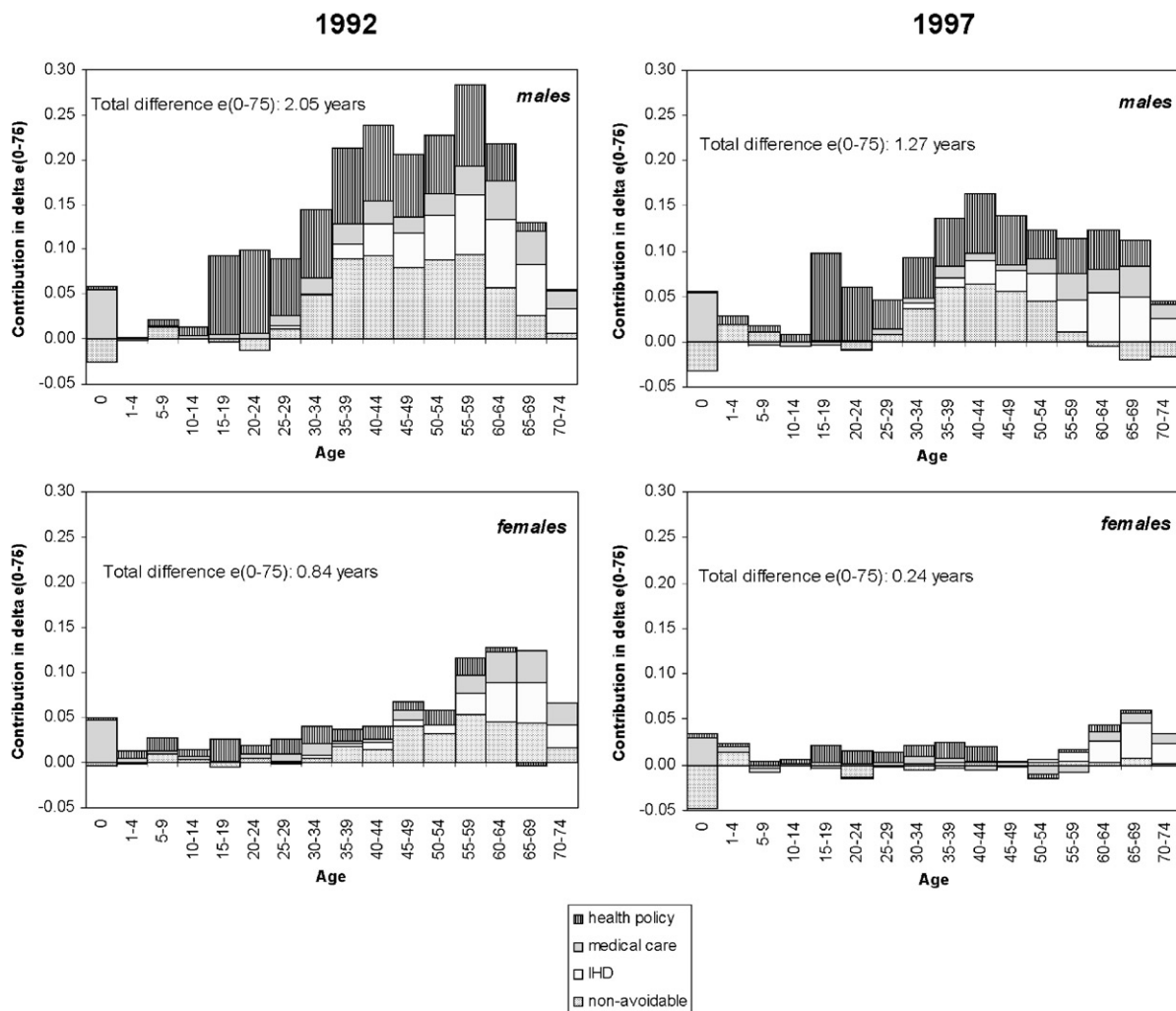
1992   **1997**

Fig. 3. Age- and cause specific contributions to differences in life expectancy between east and west Germany: 1992 and 1997.

appears not to have changed with transition (Zatoñski, McMichael, & Powles, 1998). Cause of death certification, however, apparently suffers from problems similar to those in the former GDR (Cooper, Schatzkin & Sempos, 1984). In brief, in the former GDR coding of cause of death was performed by the death-certifying doctor whereas in the FRG this is done by trained personnel at the statistical office (Brückner, 1993). Also, the WHO rule of assigning a single underlying cause of death was apparently not always followed by GDR physicians, in particular the special rule applying to cardiovascular deaths (Heinemann, Barth & Löwel, 1998). As a consequence, the distribution of diagnostic groups within the ICD category 'circulatory diseases' in the former GDR differed from those in other countries (Eisenblätter, Wolff, Michaelis & Möhner, 1994), with deaths from hypertension and

atherosclerosis being overestimated at the expense of deaths from IHD and cerebrovascular disease (Eisenblätter, Kant & Heine, 1981; Eisenblätter & Kant, 1988). A comparison of causes of inpatient deaths with the official GDR statistics from 1985 to 1989 showed that in only 57% (males) and 54% (females) of deaths from myocardial infarction was this diagnosis coded as the underlying cause of death (Heinemann et al., 1998).

Although such differences are more likely to cause comparability problems where more precise categories are used, and this paper uses broad diagnostic groups to minimise any effect, figures for IHD in the former GDR during the 1980s and in Poland for the whole period under investigation should thus be interpreted with caution. However, comparing temporal changes in mortality by cause in one country with the equivalent

changes in the other is less problematic than a direct inter-country comparison.

Formal evaluation of the quality of the Polish data has not been undertaken, but overall completeness of data is considered good and, with the exception mentioned above, believed to be satisfactory (Zatoñski & Boyle, 1996).

Avoidable mortality in the 1980s

Our findings on the potential contribution of medical care to mortality changes in east and west Germany and Poland in the 1980s agree with what has been reported elsewhere, with mortality from conditions amenable to medical care generally showing a decline in eastern and western European countries between the mid-1970s and mid-1980s (Boys, Forster, & Jozan, 1991; Bojan, Hajdu, & Belicza, 1991, 1993). A study in the former GDR, using the list of amenable conditions proposed by Charlton, Hartley, Silver, & Holland (1983), estimated the avoidable loss of life expectancy at birth between 1980 and 1987 at 0.41 years in men and 0.45 years in women (Wiesner & Zimmermann, 1990), which, despite differences in the methodological approach, is in fairly close agreement with our results.

In Poland and east Germany (for men), the improvements in mortality from amenable conditions were largely driven by declining infant mortality, while in west Germany and in east German women declining mortality among those aged 45+ was also important. Much of the improvement in adult mortality was due to declining death rates from hypertensive and cerebrovascular diseases. There is, however, some controversy about whether declining mortality from this condition can actually be interpreted as an effect of medical care or rather represents a 'spontaneous' incidence decline, perhaps reflecting the delayed impact of factors acting in utero or early childhood (Barker, 1998). Thus, in western industrialised countries including west Germany (Bergmann, Baier, Casper, & Wiesner, 1993), mortality rates have been declining since the 1960s for reasons not fully understood (Mackenbach et al., 1988). However, available evidence suggests declining case-fatality rates, pointing to the potential impact of medical intervention (Bonita, 1992; Stegmayr & Asplund, 1996).

In contrast, increasing stroke incidence rates in the former GDR in the 1970s and 1980s have largely been associated with deteriorating risk factor profiles in the population, although increasing blood pressure levels were partly attributed to less effective treatment (Eisenblätter, Heinemann, & Classen, 1995), as were high case-fatality rates in elderly stroke patients aged 65–74 years (Eisenblätter, Classen, Schädlich, & Heinemann, 1994). A failure of stroke mortality to improve in Poland between 1984 and 1992 was associated with a failure to reduce case-fatality, attributed to deficiencies in treatment of hypertension and of management of patients with acute stroke (Ryglewicz et al., 1997). This view receives support from a study showing that, in the late 1980s, in the USA, over 80% of subjects diagnosed with hypertension had their blood pressure under control whereas in Poland, the proportion was less than 20% (Rywik et al., 1998).

The trends in IHD observed in this study in the 1980s have been reported elsewhere, with declining rates in the west but increasing rates in the east (Uemura & Piša, 1988; Boys et al., 1991). But while in the west declining trends have, in part, been attributed to improved survival due to improvements in access to and quality of acute care and treatment of IHD (Bots & Grobee, 1996; Bonneaux, Looman, Barendregt, & van der Maas, 1997; Tunstall-Pedoe et al., 1999), the lack of improvement in IHD mortality in the east has not generally been interpreted as the consequence of failures in medical care. Data from acute myocardial infarction (AMI) registries in the former GDR indicate virtually unchanged case-fatality rates between the early 1970s and late 1980s, despite advances in the potential care for heart disease (Barth & Heinemann, 1994). The view that medical care played only little part was supported by a comparison of east and west German AMI registries for 1985–1989, which showed essentially no differences in case-fatality rates in men (Barth et al., 1996).

The failure of health policy, as measured by mortality from lung cancer, liver cirrhosis and motor vehicle accidents, to contribute positively to changes in life expectancy in the former GDR and Poland is perhaps unsurprising. A similar pattern was described for Lithuania (Gaiauskienë & Gurevièius, 1995). According to Zatoñski and Boyle (1996), Poland had conducted "a promotional policy regarding tobacco and alcohol. Smoking tobacco, drinking vodka, driving while intoxicated and the presence of intoxicated people on the road are socially accepted". This is mirrored by increasing mortality from lung cancer and, in men, liver cirrhosis. The change in cirrhosis mortality in Poland, however, was smaller than in neighbouring GDR, possibly a result of the temporary prohibition of alcohol that accompanied the rise of Solidarity in 1980 and the subsequent imposition of martial law (Varvasovsky, Bain, & McKee, 1997).

The increase in death rates from liver cirrhosis in the former GDR reflects an overall worsening of alcohol-related mortality since the 1970s, parallel to the steady increase in per capita alcohol consumption (Sieber, Heon, & Willich, 1998). This worsening of alcohol-related morbidity and mortality was attributed to the ease of access to alcohol in the former GDR where, despite economic problems in the 1980s, even small shops offered up to 50 different alcoholic

beverages but only a limited range of vegetables (Casper, Wiesner, & Bergmann, 1995).

In summary, in the 1980s, in east Germany, about 50–60% of the improvement in temporary life expectancy between birth and age 75 was due to declining mortality from conditions amenable to medical care. The corresponding figure in west Germany was 30–40%. These causes also exerted a net positive effect in Poland, although there it was counterbalanced by deterioration in IHD mortality. These figures, do, however, mask differences in impacts at different ages. The improvements in the former socialist countries were due, largely, to improvements in infant mortality. In contrast, gains in west Germany depended, to a considerable extent, on reductions in deaths among adults. Thus, it would appear that while the east German and Polish health care systems were able to tackle the often acute conditions that lead to death in infancy, they were much less well equipped to address the challenges of chronic conditions, requiring prolonged and often expensive treatment (Niehoff, Schneider, & Wetzstein, 1992). In addition, there was a failure in east Germany and Poland to implement effective policies on the broader determinants of health.

Avoidable mortality in the 1990s

By the 1990s this pattern had changed considerably. The relative contribution of medical care in the former socialist countries was less than in the 1980s, but now benefited not only infants but also adults, particularly in women. This suggests that changes in medical care associated with the socio-economic transition actually did contribute to changes in life expectancy in east Germany and Poland.

However, improvements at older ages were less pronounced in Poland than in east Germany. This may be because the change in the health care system was greater in east Germany. This is supported by the observation that there was a much smaller decline in mortality from hypertensive and cerebrovascular diseases in Poland in the 1990s than in east Germany. The health care system changes in east Germany may plausibly be expected to have resulted in improved treatment of elderly patients with stroke, who were reported to have been relatively under-treated during the communist period (Eisenblätter et al., 1994). This hypothesis receives indirect support from a study on provision of dialysis. Between 1989 and 1994 there was a two- to three-fold increase in dialysis facilities in east Germany, accompanied by a 2.5 fold increase in the number of patients receiving regular treatment (Thieler et al., 1994; Thieler et al., 1995). This was due largely to increased treatment of elderly and diabetic patients who had been given lower priority because of shortage of funds in the former GDR (Knox, 1993).

The overall impact of medical care on improvements in life expectancy in men was, however, less than that resulting from the decline in mortality from IHD or from preventable conditions. Substantial improvement in IHD mortality in post-communist Poland has been attributed, largely, to changes in dietary pattern, with increasing intake of fresh fruit and vegetables and reduced consumption of animal fat (Zatoñski & Boyle, 1996; Zatoñski et al., 1998). The authors considered the contribution of medical care to declining IHD mortality in Poland to be negligible, although data from the WHO MONICA centres in Poland suggest that there had been a considerable increase in intensity of treatment of acute coronary events between 1986/89 and the early 1990s (Tunstall-Pedoe et al., 2000).

However, a much higher proportion of deaths from IHD are sudden in Poland compared with the west. This phenomenon has also been noted in the neighbouring Baltic Republics (Uuskula, Lamp, & Vali, 1998) and Russia (Tunstall-Pedoe et al., 1999). One explanation lies in the major role played by binge drinking in sudden cardiac death in this region (McKee, Shkolnikov & Leon, 2001). This, in turn, would support the hypothesis of medical care being of minor importance for the overall decline in IHD mortality in Poland in the 1990s.

A similar conclusion could be drawn for post-communist east Germany, where WHO MONICA data indicate essentially no change in intensity of treatment of acute coronary events between 1988/1990 and 1991/1993, and an actual deterioration in hospital-related, and overall case fatality, as well as in event and death rates in both sexes (Tunstall-Pedoe et al., 2000). However, the quality of acute coronary care data may be questionable (Mähönen, Cepatis, & Kuulasmaa, 1999). Other evidence suggests that later in the 1990s there was a substantial increase in a variety of indicators implying intensified treatment of cardiovascular disease in east Germany (for example an increase in IHD-related surgery, by 530% between 1993 and 1997 (Brenner et al., 2000)). The number of coronary catheterization units increased from 7 in 1990 to 42 in 1997 (Bundesministerium für Gesundheit, 1998). There was also a considerable increase in the number of primary pacemaker implantations after unification, from 220 per million population in 1986/1987 to 450–490 in 1993/1995 (Spitzer, 1999). Although intensified treatment does not necessarily translate into improved survival (Marques-Vidal et al., 1997), available data suggest that a non-significant increase in prevalence of myocardial infarction in east Germans aged 25–69 years between 1990/1992 and 1997/1998 accompanied the decline in IHD mortality, possibly due to improved survival (Wiesner, Grimm, & Bittner, 1999). The decline of IHD mortality among west German men, on the other hand, was attributed to a decline in incidence of

myocardial infarction, due to more effective medical treatment and therapeutic procedures (Löwel et al., 1995). The contribution of medical care to the overall improvement in temporary life expectancy especially in west Germany may thus have been higher than estimated in this study.

For women in both east and west Germany, the relatively higher impact of medical care compared to men is because causes considered amenable include breast cancer. The failure of policy measures showing an effect similar to men is largely attributable to lung cancer death rates that continue to increase in women but not in men, as in other industrialised countries (Levi, Lucchini, La Vecchia, & Negri, 1999). In men, on the other hand, the relatively higher impact of policy measures on improvement in temporary life expectancy was largely attributable to a decline in mortality from motor vehicle accidents, a phenomenon described in detail elsewhere (Winston, Rineer, Menon, & Baker, 1999; Nolte et al., 2000b). In east Germany, and to a lesser extent in west Germany, there was also a decline in mortality from liver cirrhosis, possibly attributable to a decline in alcohol consumption during the 1990s (Kraus & Bauernfeind, 1998).

In summary, changes in amenable mortality indicate that the contribution of medical care in east Germany and Poland in the 1990s was less than in the 1980s. However, as noted earlier, improvements now benefited also adults. It would thus appear that changes in the health care system associated with the socio-economic transition did impact changes in life expectancy in east Germany and Poland. The impact differed, however, between regions as improvements at older ages were less pronounced in Poland compared to east Germany, possibly due to system-associated changes in health care being greater in the latter.

The east–west mortality gap in the 1990s

The greater progress in terms of temporary life expectancy achieved in the former GDR resulted in a substantial reduction in the mortality differential between the two parts of Germany, particularly for women. The relative contribution of the different causes to the remaining life expectancy gap, however, remained fairly stable, or even increased for preventable conditions. With respect to death rates from liver cirrhosis and motor vehicle accidents, the continuing mortality differential is perhaps not surprising given the evidence of higher consumption of hazardous amounts of alcohol in the east (Kraus & Bauernfeind, 1998).

Regarding the impact of medical care, available evidence suggests that, despite the major achievements in rebuilding the health care system in the former GDR, outcomes continue to lag behind west Germany. This is illustrated by the finding that, despite a considerable improvement since 1991, neonatal mortality in east Germany in 1996 could have been lowered by a further 20% if birth weight specific neonatal mortality rates seen in the west had applied (Nolte et al., 2000c). Other evidence suggests substantial east–west differences with respect to cancer survival, at 26.5% and 44.8% in east German men and women compared with 38.9% and 50.4% in the west (Becker & Wahrendorf, 1998). These figures, however, apply to the immediate pre-unification period and it is as yet not clear to what extent these differences still persist.

The concept of avoidable mortality

Clearly any division between indicators of avoidable mortality as used in this study is, to some extent, artificial, as a death from any cause is typically the final event in a complex chain of events. The choice of category is essentially based on a judgement about the relative effectiveness of different interventions that might prevent death, working from the health care system backwards. Thus amenable conditions are those from which it is reasonable to expect death to be averted even after the condition is developed. This covers diseases such as appendicitis and hypertension, where the medical nature of the intervention is apparent. They also include causes of death susceptible to secondary prevention through early detection and effective treatment, such as cervical cancer, for which effective screening programmes exist, and such as tuberculosis where, although the acquisition of disease is mainly driven by socio-economic conditions, timely treatment is effective in preventing mortality.

Preventable conditions are those from which medical care may be less effective once the condition has occurred but where there are interventions that are known to be effective in preventing the condition from occurring. These include causes whose aetiology is, to a considerable extent, related to lifestyle factors, most importantly the use of tobacco and alcohol (lung cancer and liver cirrhosis). This group also includes deaths amenable to legal measures such as traffic safety (speed limits, use of seat belts and motorcycle helmets).

It is difficult to assess the precise impact of particular interventions on some conditions. Declining mortality from cardiovascular may have been due in part to changes in diet and thus 'preventable', while improvements in mortality from traffic accidents may also have been impacted by substantial improvements in emergency services, and thus 'treatable'. This certainly requires further research, especially regarding the specific role of IHD.

An intrinsic problem with the concept of 'avoidable' mortality is, of course, that it takes no account of differences in the underlying prevalence or severity of a

disease. Data from the recent German Federal Health Survey showed for example that, in 1998, prevalence rates of hypertension and diabetes mellitus were considerably higher among east Germans aged 18–79 than among their west German counterparts (Thamm, 1999; Thefeld, 1999). These data do suggest a higher burden of cardiovascular and endocrine morbidity in east Germany, which in turn could explain some of the higher mortality from respective diseases.

Conclusions

In conclusion, our findings suggest that, firstly, improvements in medical care after the political transition were associated with improvements in life expectancy in east Germany and, to a lesser extent, in Poland. Secondly, differences in the quality of medical care as assessed by the concept of 'unnecessary untimely deaths' appear to contribute to a persisting east–west health gap at a scale fairly comparable to that estimated by Velkova, Wolleswinkel-van den Bosch, and Mackenbach (1997), at 25% in men and 26% in women in 1988, and higher than generally assumed (Bobak & Marmot, 1996). This is, of course, not to neglect the possibly more important role of factors outside the scope of medical care in the continuing mortality differential. These include diet, alcohol consumption, smoking and socioeconomic factors, as indicated by the relatively higher contribution of preventable conditions. Our data do, however, suggest that reducing differences in the effectiveness or quality of medical care still seems to hold a greater potential to reduce mortality differences than has been assumed so far.

In 1997, conditions considered avoidable through medical care or health policy measures accounted for between 27% (west Germany) and 32% (east Germany) of mortality under 75 in men and 33–35% in women. In men, 39% (east and west Germany) and 48% (Poland) of avoidable conditions were those amenable to medical care. Among women, the corresponding figures were 70% in east and west Germany and 80% in Poland. Taken as a whole, and in the light of the considerable body of supporting evidence, these findings indicate that medical care has made a significant contribution to the improvements in population health in the countries concerned over the last two decades. The contribution has, however, differed over time and between countries. Our findings suggest that the transformation of the east German health care system brought tangible improvements in mortality that were greater than in west Germany, where the existing system continued in place, or in Poland, where reform has been much slower. Especially in Poland and the former GDR there remains

potential for further progress that would help to close the health gap with the west.

Acknowledgements

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