

# MONICA Graphics

Prepared by Hanna Tolonen (Helsinki) and Hugh Tunstall-Pedoe (Dundee)  
Commentary and notes by Hugh Tunstall-Pedoe

## #89 MONICA Graphics

### Introduction

The analysis of the final results of the WHO MONICA Project involved the creation of large numbers of complex tables. These were eventually reduced to six or so for each of the MONICA Publications. Each table needed to encompass between 15 and 38 populations, to show the results for men and women, and to include different factors and end-points. Their preparation involved a formidable amount of work. This was matched by the challenge, first to the editorial staff of the journals and the reviewers, and then to the readers of the papers when they eventually appeared. Understanding a two-by-two table is a problem for many readers. MONICA tables commonly had 20 or more columns and 40 rows.

While the manuscripts were being prepared for publication, preliminary results were being communicated to cardiology, stroke, epidemiology, and public health conferences. Complex tables cannot be projected onto a screen. MONICA needed to summarize its findings graphically, in a way that made sense within a few seconds to a professional audience.

By trial and error we developed a MONICA style. Over a number of years a portfolio of slides was created, shown at international meetings, and distributed to MONICA investigators for local use. Publication of MONICA results in scientific journals might be thought to have made these slide images redundant. Readers of scientific papers tend to be more interested in the conclusions than in the data. But the WHO MONICA Project has an incomparable collection of data, of interest to many investigators beyond those concerned with the testing of the MONICA hypotheses. There was a danger that MONICA graphics summarizing the data would be lost to the wider audience in cardiovascular disease and public health. Even this professional audience preferred graphics to tables, wanted to see them, and to be able to study them in their own time.

The following graphics are therefore a key product of the MONICA collaboration, and one of the reasons for producing this Monograph. No other study has produced standardized data of such range and value. The graphics should encourage those looking at them in this book to go on to do some or all of a number of things: explore the MONICA Publications (2) study the MONICA Quality assessment reports (1), look at the MONICA Data Books; check the MONICA Website (1), and even analyse the sample Data Base on the CD-ROM.

Developed originally for transient presentation, the slides have been reviewed and revised meticulously before appearing here in print. In addition, a number of the graphics that follow have been prepared specifically for this Monograph.

Three slide formats are of particular interest in the history of presenting MONICA collaborative results. One is the presentation of trends, exemplified for example by G15 or by G38, a MONICA standard. The second is their simplified rendering into 'traffic-light' symbols in the spot-maps such as G24, G25 and G39—too simple for publication in scientific journals, but of great educational value. The third illustrates how results of major publications can be simplified into single images such as G23 and G31. These are examples of the formidable challenge of making research results understandable to a wide readership. They illustrate how complex epidemiological findings can be summarized simply through an understanding of mathematical relationships, even though this final format was achieved only after considerable labour and numerous false starts.

1. See [Monograph CD-ROM or MONICA Website http://www.ktl.fi/monica/](http://www.ktl.fi/monica/).
2. Full references and summaries of MONICA Publications appear in #85/86.

## Populations, data collection and official mortality

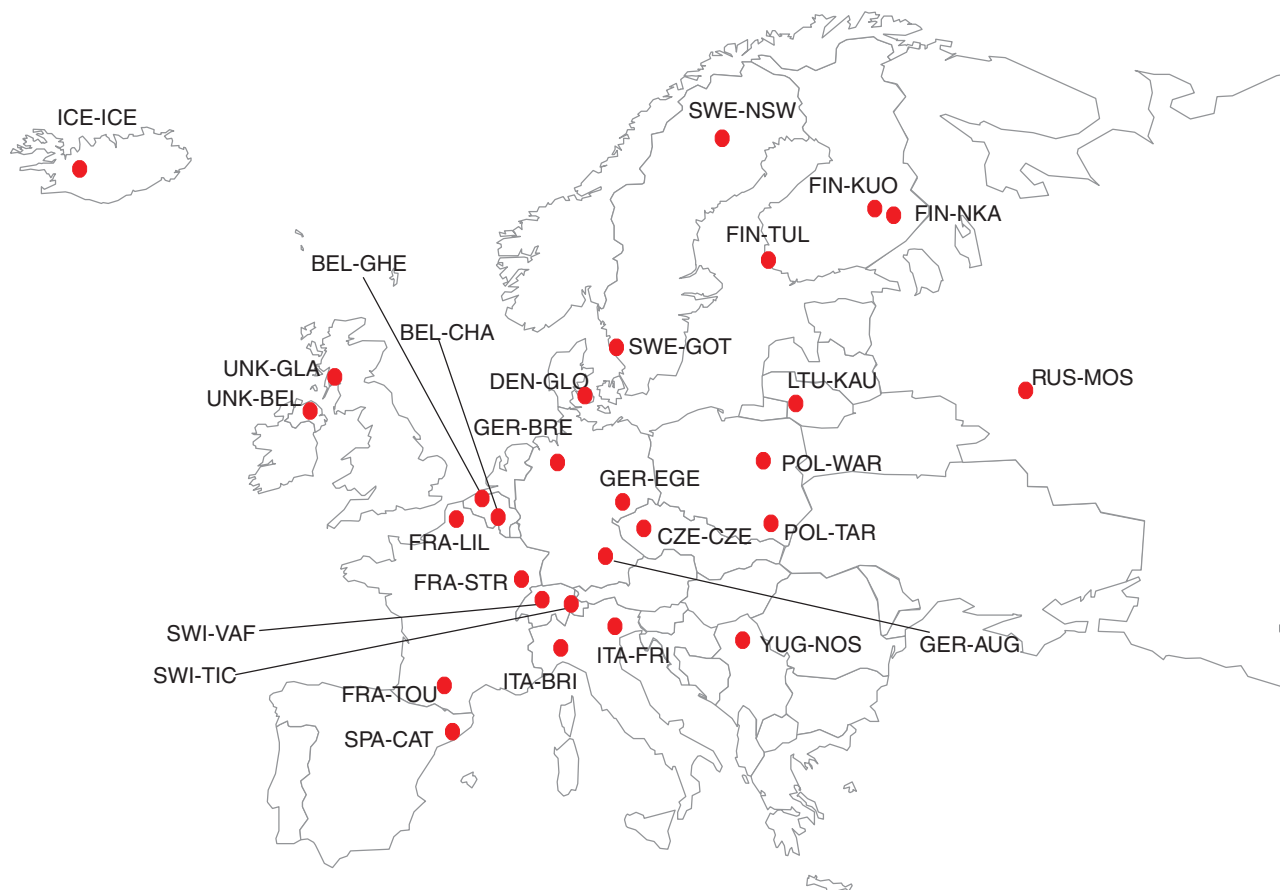
1. To qualify for the final testing of the MONICA hypotheses populations needed to provide approximately ten years of 'core data', that is data on trends in coronary-event rates, trends in cardiovascular risk factors and trends in coronary care. For testing the stroke hypotheses, data on trends in stroke rates were needed. These data were sent to the MONICA Data Centre in Helsinki, where they underwent formal quality assessment before they were used. See #7 *MONICA Data Centre (MDC)*, #12 *Quality Assurance*, MONICA Manual Part I, Section 1 (1).
2. Populations are known in the WHO MONICA Project as Reporting Unit Aggregates, abbreviated to RUAs. Each is identified in this Monograph and in the later MONICA Publications (2) by a seven-character code. The first three characters are the national country code, followed by a hyphen, and then the three-character population code. Characteristics of each population are described in #51–#83. See MONICA Manual Part I, Appendix 2 (1), also *Appendix*.
3. Populations from former MONICA Collaborating Centres (see *Glossary*), provided material for the early parts of the study, but are not shown in maps G1 and G2. Either the quantity or the quality of their data were inadequate to contribute to the analysis of 10-year trends, and therefore to hypothesis testing. These populations are listed in #84. Some of their data were processed in the MONICA Data Centre and appear in MONICA Quality assessment reports (1), MONICA Data Books (1), and in early MONICA Publications of cross-sectional data, or of five-year trends, such as 1, 2, 3, 10, 15 (2).
4. There were changes over time in the number of countries involved in the WHO MONICA Project. Some withdrew, some joined together (two Germanies), and some separated (republics of the former Soviet Union). The final total was 21.
5. There are 35 MONICA population RUAs shown in maps G1 and G2, seven outside Europe and 28 within. The number of RUAs used varied between analyses, some using more than 35 and some fewer:
  - a. The first major analysis on 10-year trends in coronary-event rates, case fatality and mortality rates, for MONICA Publication 36 (2), used 37 RUAs. The two Russian cities shown here, Russia-Moscow, RUS-MOS, see #74, and Russia-Novosibirsk, RUS-NOV, see #75, were each split into 'intervention' and 'control' population RUAs.
  - b. The largest number of RUAs was used in testing the First MONICA Hypothesis, also known as the risk-factor hypothesis, see #2 *MONICA Hypotheses and Study Design* for MONICA Publication 38 (2). In addition to the 37 RUAs used in the coronary-event paper, Germany-Augsburg, GER-AUG, see #63, was split into 'urban' and 'rural' RUAs, making 38.
  - c. In testing the Second MONICA Hypothesis on coronary care, see #2, for MONICA Publication 39 (2), the 35 population RUAs shown in G1 and G2 were all used, but only after amalgamating the two from Belgium into one, the two from Switzerland into one, and three from Finland into one, leaving 31 separate RUAs.
  - d. The two Swiss populations provided information on core data items in men, but only on risk factors in women. Therefore there are fewer population RUAs for women, compared with men, in many of the following graphics. Exceptions are risk-factor graphics G36–G56 (Swiss men and women both represented) and stroke graphics G26–G35 (neither).
  - e. Fifteen RUAs from ten countries provided data for testing the stroke hypotheses. They are identified in #26 *Registration of Stroke Events*, and G9. In addition GER-EGE, see # 65, provided data over six years.
6. The MONICA Protocol specified that all data components should be measured in the same defined populations. See MONICA Manual Part I, Section 1 (1). For local technical reasons, described in the relevant MONICA Quality assessment reports, this did not always happen. Variants of the same population, where the RUAs may overlap, are shown in Data Books by suffixes a, b, c, for example AUS-PERa, AUS-PERb. Overlapping but different RUAs explain why the graphics occasionally differ from MONICA Publications for a particular RUA. See *Appendix* where the RUAs used in each graphic are defined in terms of their constituent MONICA reporting units. (Other discrepancies from the early MONICA Publications result from different age standardization. See #39 *Age Standardization*.)

1. See **Monograph CD-ROM or MONICA Website** <http://www.ktl.fi/monica/>.
2. **Full references and summaries of MONICA Publications appear in #85/86.**

## G1 Populations outside Europe used in testing the MONICA hypotheses

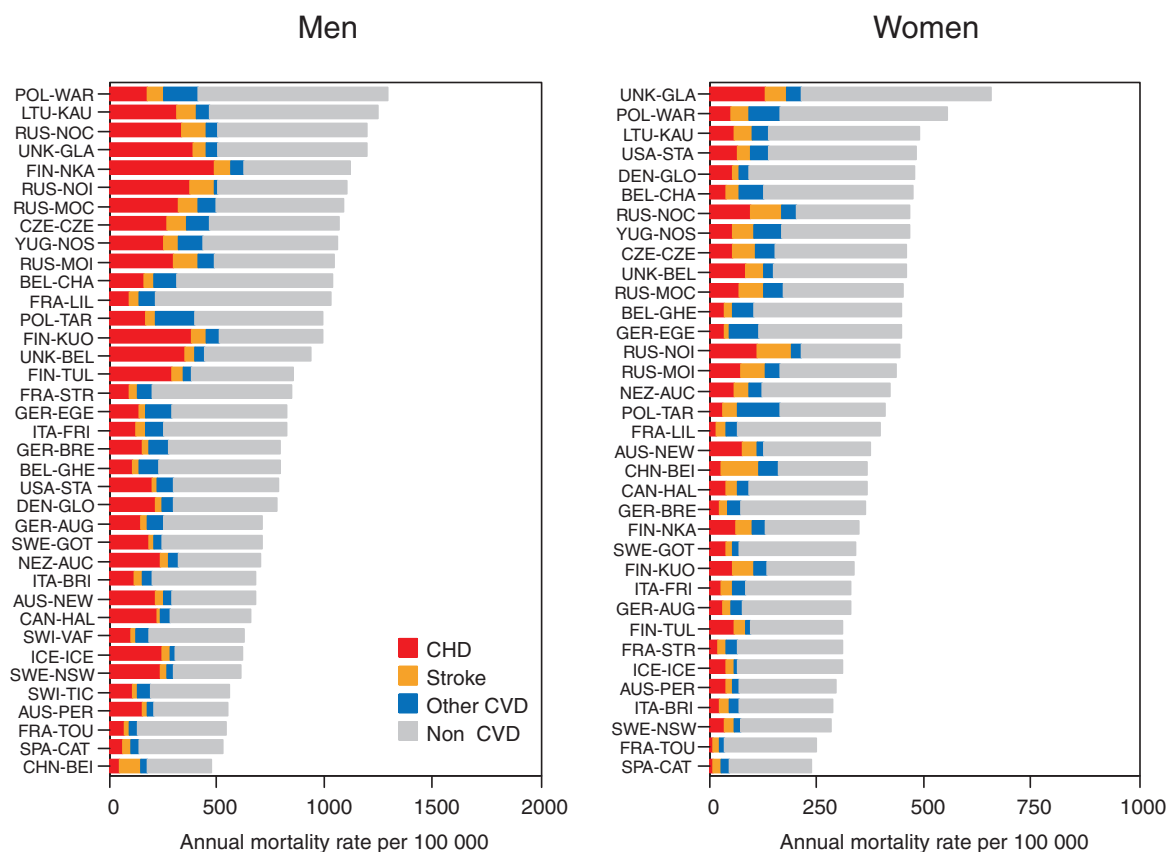


## G2 European populations used in testing the MONICA hypotheses

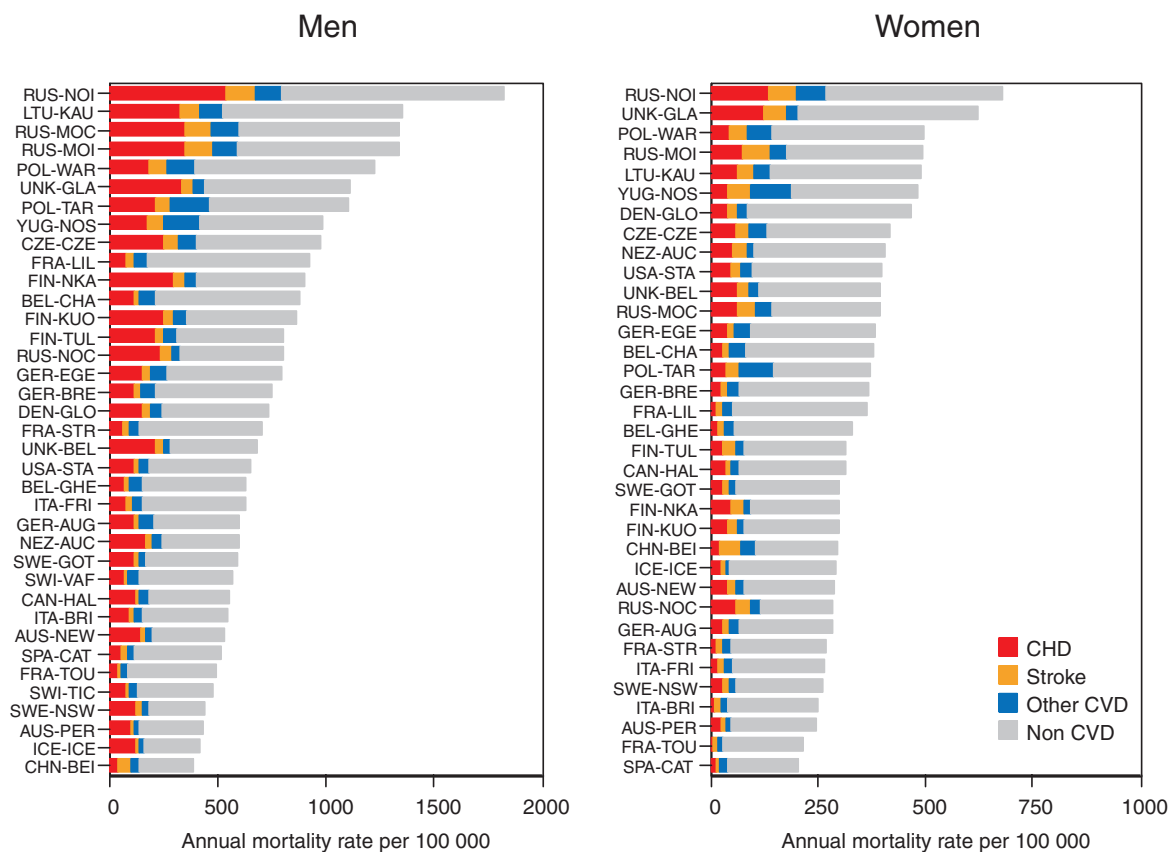


1. These charts incorporate the official, routine, death certificate data, obtained directly from local or national statistical sources. MONICA registration procedures for validation and diagnostic classification of coronary and stroke events have not been applied. Population denominators are the same as those used in calculating MONICA event rates, as are the methods of age standardization. Discrepancies between these results and those for coronary and stroke mortality after MONICA validation therefore result from different numerators, not differences in denominators or in age standardization. See #16 *Routine Mortality Data*, #37 *Event Rates, Case Fatality and Trends*, #39 *Age Standardization*, MONICA Quality assessment of demographic data (1).
  2. According to basic international coding rules, even if there are several causes, or a sequence of causes of death written on a death certificate, each death is assigned a single 'underlying' cause. Deaths or death rates from single causes can be added up therefore to give the total number of deaths or death rates from all causes (that is, from any cause).
  3. CHD is coronary heart disease, also known as IHD, or ischaemic heart disease. See *Glossary*.
  4. Stroke is also known as cerebrovascular disease. See *Glossary*.
  5. Other CVD are cardiovascular diseases (that is diseases of the heart and circulatory system—arteries, veins and lymphatics) other than coronary heart disease and cerebrovascular disease.
  6. Non-CVD are all other causes of death, such as infections, cancer, respiratory disease, injury and poisoning, to name a few.
  7. The three years specified for each graph varied by population. They are the starting and stopping years for coronary-event registration in the population concerned, shown graphically in G8.
  8. Results, as in many of the following graphs, are age-standardized for the 35–64 age group, using the world standard population. See #39 *Age Standardization*.
  9. Note that the scale maximum for women on the x-axis is only half of that for men.
  10. The bar charts allow comparison of mortality rates between populations and between the sexes. Comparison of G4 with G3 shows changes in mortality rates and in consequent population ranking over time.
  11. Some of these mortality data were used in the early MONICA Publications 1, 6, 10, 16 (2).
1. See **Monograph CD-ROM or MONICA Website** <http://www.ktl.fi/monica/>.
  2. **Full references and summaries of MONICA Publications appear in #85/86.**

### G3 Death rates from various causes: first three years of coronary-event registration

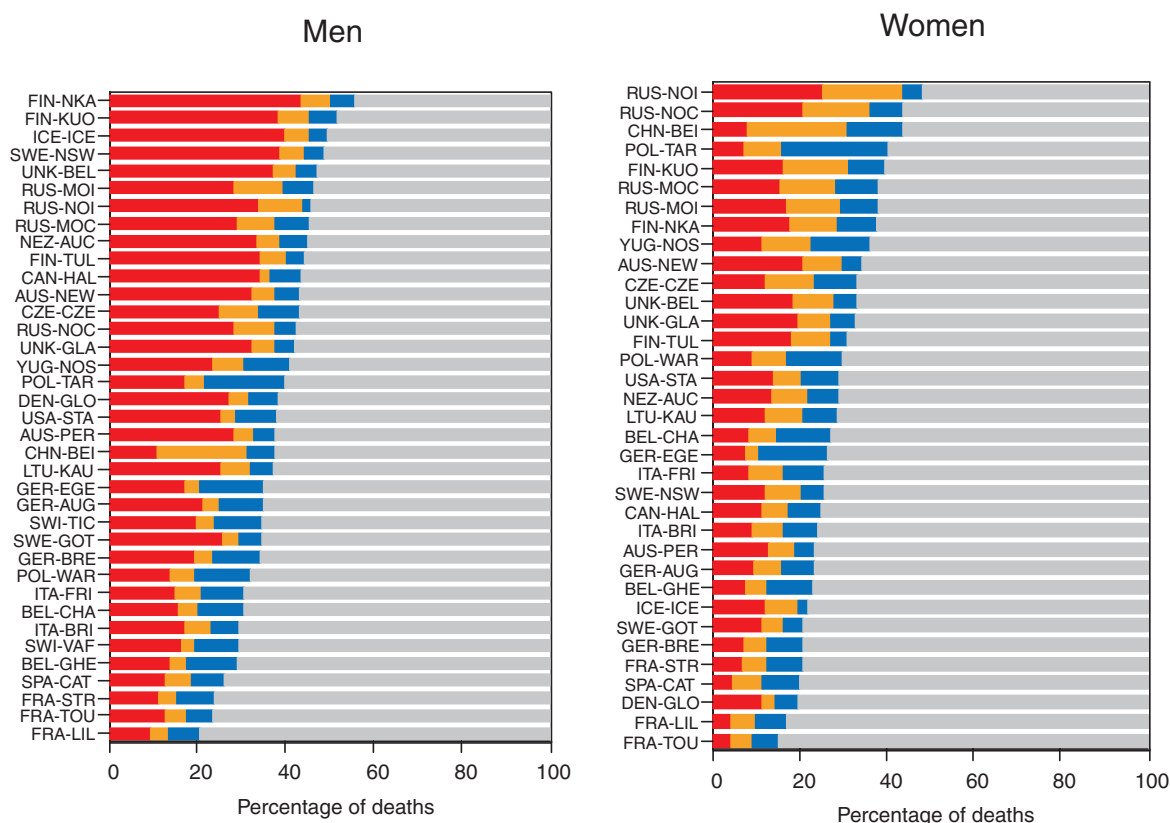


### G4 Death rates from various causes: final three years of coronary-event registration

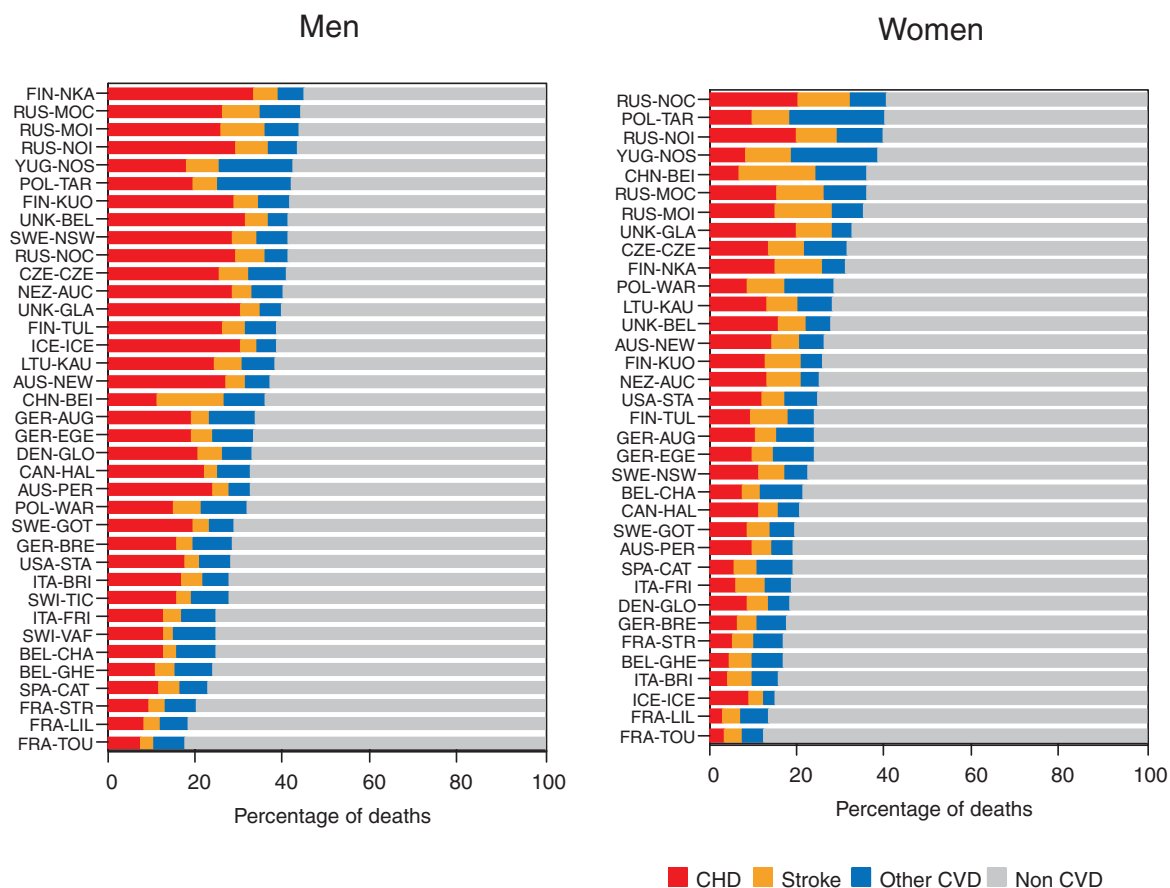


1. As in graphs G3 and G4 the official, unvalidated cause of death is used. Here the denominator is all the deaths in that sex. Demographic data on population numbers are not essential for the calculation of what is called proportional mortality. However in this case the calculation was made using mortality rates.
2. The disease groups are described for G3 and G4 (previous page), as is age standardization.
3. There is more than two-to-one variation in the proportion of all deaths attributable to cardiovascular disease in different populations. The proportion is generally higher in men than women. The sex difference is smaller than the difference within one sex between different populations.
4. There is variation also in the proportion of all cardiovascular deaths attributable to coronary heart disease, stroke and other cardiovascular diseases. A geographical pattern is apparent.
5. The distribution of proportions of deaths from different causes is not changing greatly over time.
6. Proportional mortality analyses such as these have not featured in MONICA Publications.

## G5 Ranking of populations by proportion of all deaths from cardiovascular causes: first three years of coronary-event registration



## G6 Ranking of populations by proportion of all deaths from cardiovascular causes: final three years of coronary-event registration



## G7

1. 'Hot pursuit' (red dots in G7) is the identification of potential cases of non-fatal myocardial infarction from their admission to hospital. 'Cold pursuit' (blue dots in G7) is identification from documents, particularly paper or computer listings produced on discharge from hospital. See #20 *Registration of Coronary Events, Hot and Cold Pursuit*, and MONICA Manual Part IV, Section 1 (1), MONICA Publications 4, 10, 16 (2). Despite concern about comparability at the time, the method of identifying cases for registration did not appear to show any systematic geographical pattern, or to have a systematic effect on results. G7 shows that different MONICA Collaborating Centres (MCCs) within one country, responsible for neighbouring RUAs, often employed different methods for identifying cases. In some population RUAs a combination or intermediate methods were used—sometimes these changed over time.

## G8

2. Years chosen for coronary-event registration were those in which data were available and passed the quality assessments of the MONICA Data Centre. See MONICA Quality assessment of coronary event registration data (1). The years shown in G8 define the initial and final years used for graphs G3–G6, and for many later graphs. All 38 of the population RUAs from MONICA Publication 38 (2) are included.

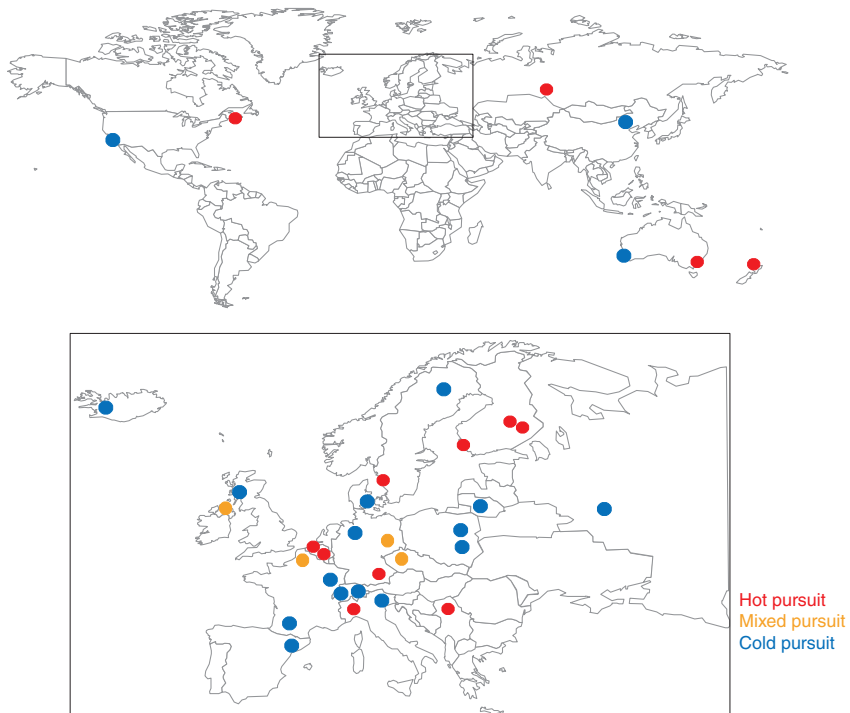
3. Starting and stopping dates varied between populations. Twenty-two of the 38 main MONICA hypothesis-testing population RUAs began by 1 January 1984; all 38 monitored coronary events together for the seven years 1 January 1985–31 December 1991; all but two, Denmark-Glostrup, DEN-GLO, see #57, and New Zealand-Auckland, NEZ-AUC, see #71, continued past the end of 1992, and just nine more stopped at the end of 1993. Twenty-seven of the 38 therefore registered coronary events for the same nine years, 1985–1993 inclusive.

4. The 'lagged' registration period, shown in red in G8, was used when testing the First MONICA Hypothesis on coronary risk factors, see #2 *MONICA Hypotheses and Study Design*. Trends in coronary-event rates were calculated twice: firstly over the full period (blue plus red bars) without any time difference from the measurement of trends in risk factors, and secondly after a delayed onset of several years. See G70, G72 and MONICA Publication 38 (2).

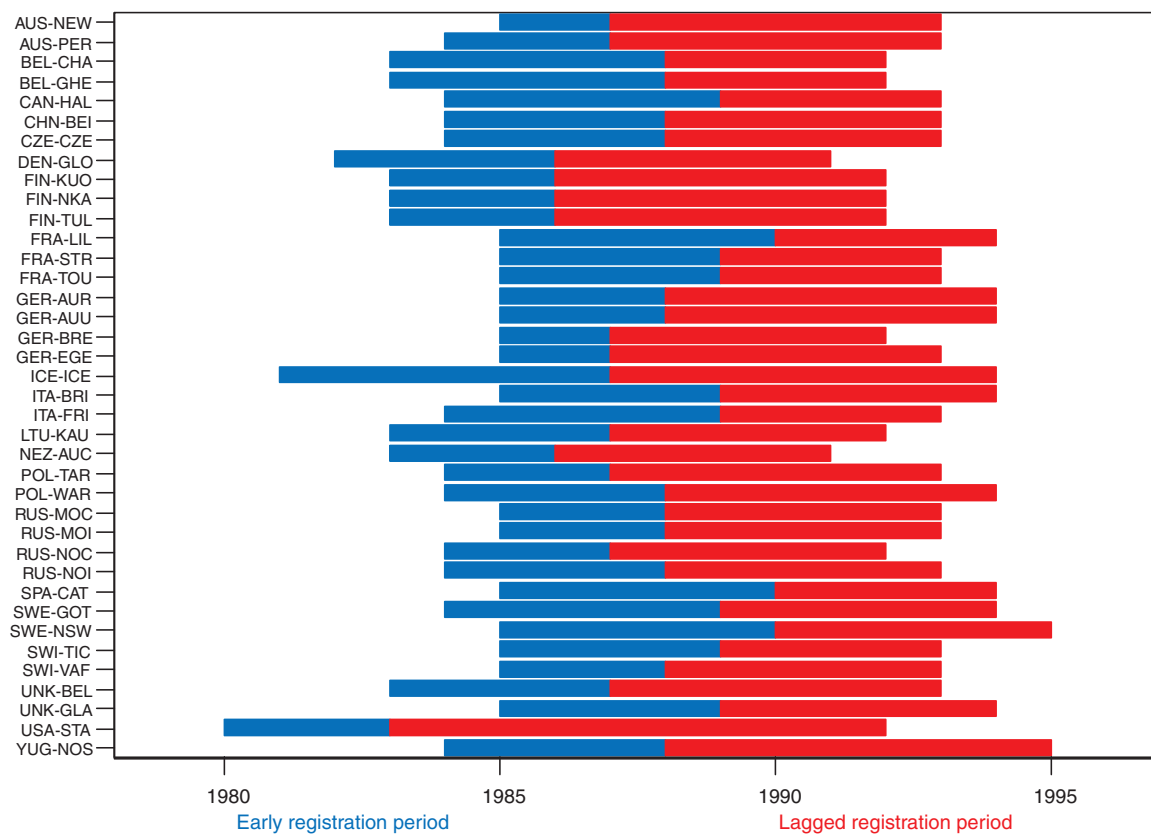
1. See [Monograph CD-ROM or MONICA Website http://www.ktl.fi/monica/](http://www.ktl.fi/monica/).
2. Full references and summaries of MONICA Publications appear in #85/86.



## G7 Populations using different methods of identifying non-fatal cases for coronary-event registration



## G8 Years of coronary-event registration in different populations



## G9

1. The 38 MONICA population RUAs in which long-term coronary-event registration took place have been described previously. Equivalent stroke registration took place in 15 RUAs. Years chosen for analysing stroke events were those in which data were available, and passed the MONICA quality control checks for stroke. These years were not necessarily the same years as those in which registration of coronary events took place in the same population RUAs although they could be. Equally, the years were not always the same in related populations. Compare G8 and G9. There are differences in G9 between the three Finnish centres, see #58, and between the two RUAs from Russia-Novosibirsk, see #75. In addition to the 15 populations used to test the MONICA stroke hypotheses, others registered stroke for shorter periods, contributing to early cross-sectional analyses and papers on stroke methods. See MONICA Quality assessment of stroke event registration data (1), Germany-East Germany, #65 GER-EGE, #84 Former MONICA Populations.
2. The 'lagged' registration period was used in testing the First Hypothesis for stroke. See note 4 on previous page referring to G8, G74 and G76. See MONICA Publication 45.
3. Although MONICA was set up to monitor both coronary disease and stroke, monitoring of the latter could not be made obligatory. There were formidable problems in setting up long-term coronary-event registration and conducting repeated population risk-factor surveys before embarking on stroke. Reasons why approximately half of the MONICA Collaborating Centres did not register stroke as well as coronary events included the following:
  - A primarily cardiac focus resulting in lack of interest in stroke.
  - Insufficient resources and manpower to set up a second registration system.
  - Doubts whether numbers of strokes below age 65 would be sufficient to establish local trends, coupled with reluctance to include older age groups. (Half the stroke registers did do so.)
  - Finally in the early 1980s there was concern that registration of non-fatal stroke events would be incomplete in populations where they might be managed away from large hospitals in domiciliary practice. Now modern management of stroke has made referral to hospital a routine.

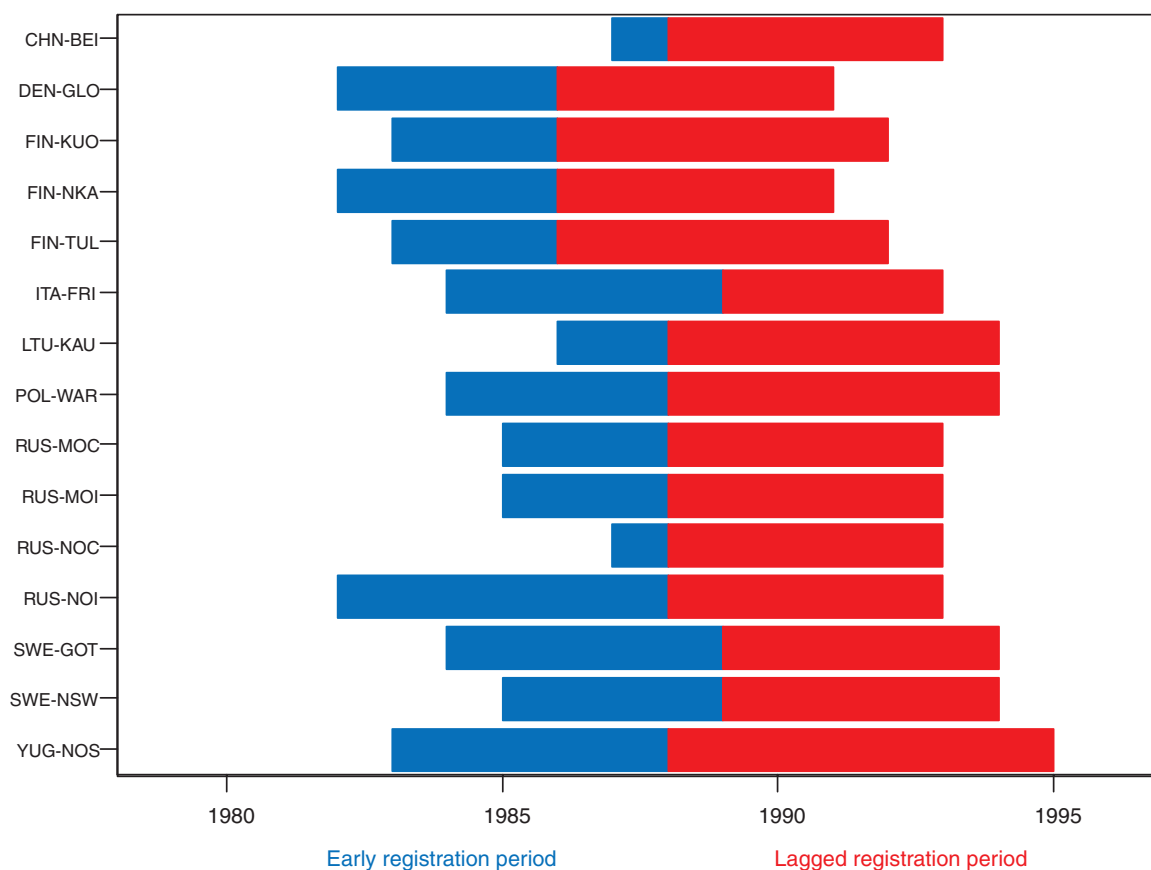
MONICA stroke registers tended to reflect local enthusiasm by neurologists or those concerned with diseases of the elderly, as well as epidemiologists. Coronary registers were attractive to cardiologists.

## G10

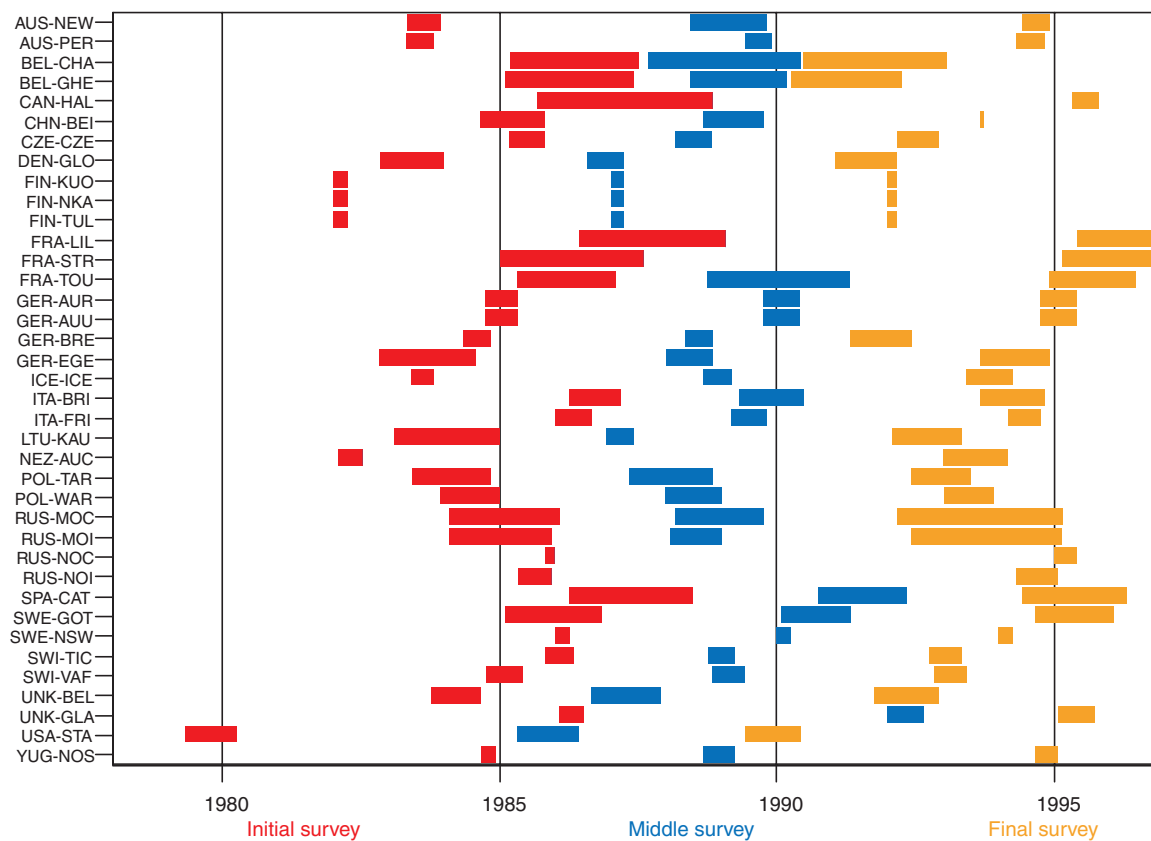
4. To participate in testing the coronary and stroke risk-factor hypotheses, MCCs had to establish trends in risk factors in their population RUAs by mounting an initial and a final population risk-factor survey. A middle survey was recommended but optional.
5. Surveys were not initiated at the same time in different populations. Some lasted only a few months. There was less chance of their occurring simultaneously across populations than was true for coronary or stroke-event registration. That was longer-term.
6. Because risk-factor levels may fluctuate according to the season of the year, investigators were encouraged to standardize the calendar months in which their risk-factor surveys were replicated. This was not always possible through delays in funding, initiating and completing the surveys. See MONICA Quality assessment of age, date of examination and survey periods (1).
7. Ideally, the first population surveys in each RUA would have preceded or been simultaneous with the start of event registration. It was not generally feasible to start both registration and population risk-factor surveys together. Coronary and stroke-event registration often started before population risk-factor monitoring. This was because event registration was more problematic. It took longer to pilot and then get up and running smoothly, so attention was focused on that before initiating the population risk-factor surveys. Compare G10, with G8, and G9.

1. See **Monograph CD-ROM or MONICA Website** <http://www.ktl.fi//monica/>.

## G9 Years of stroke registration in different populations



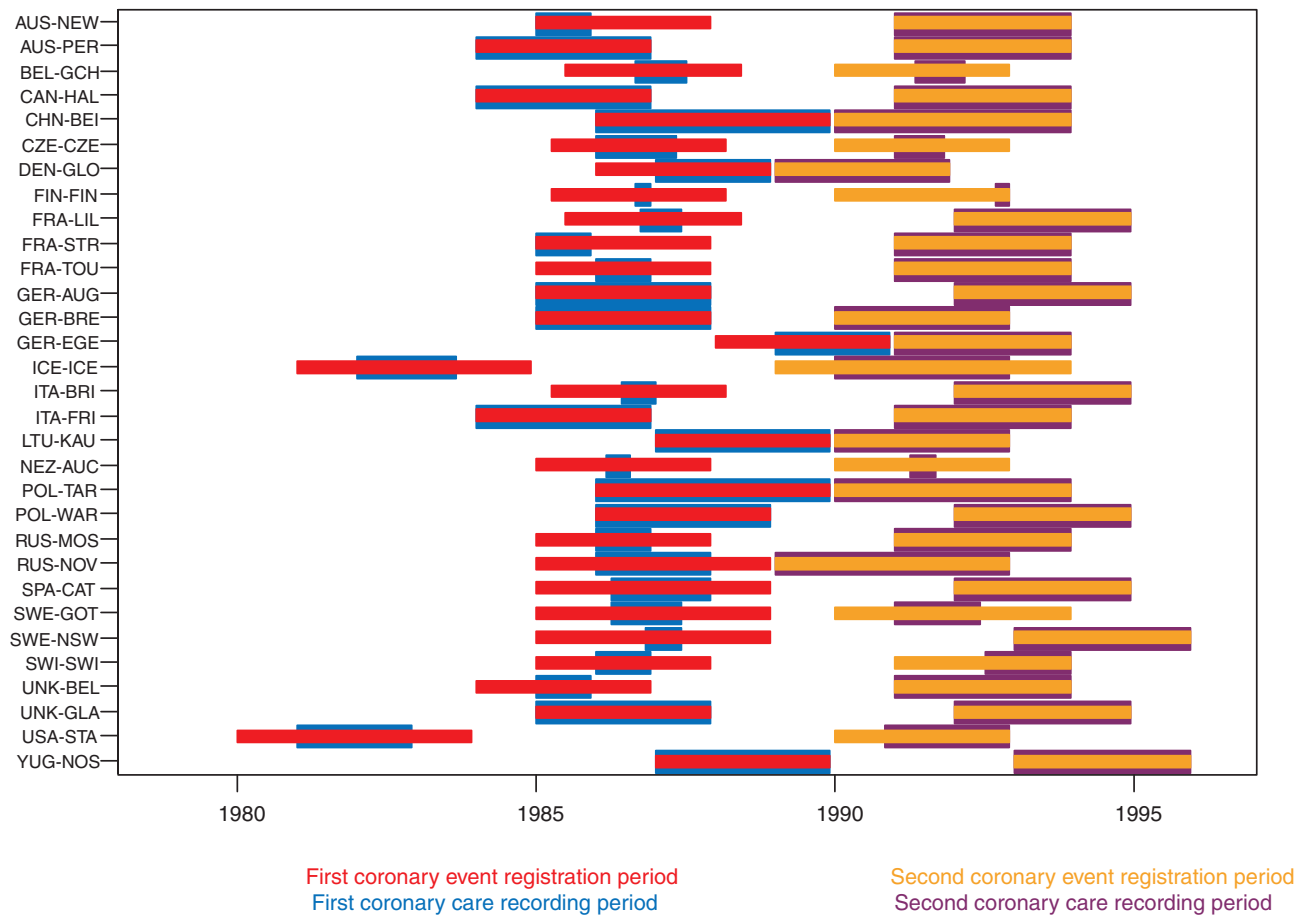
## G10 Timing of risk-factor surveys in different populations



1. Coronary-care recording was more limited in duration in most population RUAs than coronary-event registration, particularly in the early years of the MONICA Project. However, some MCCs monitored both data components in their RUAs from start to finish. See #24 *Acute Coronary Care*, MONICA Quality assessment of acute coronary care data (1), MONICA Data Book of coronary care (1).
2. To test the coronary-care hypothesis, differences in coronary care and rates of coronary end-points were measured across two separate time periods. See G57–G68 and G77, MONICA Publication 39 (2).
3. This graph therefore depicts only the defined time periods used in testing that hypothesis, and not the total amount of coronary-care data available. For the same reason G11 shows only part of the coronary-event period of registration.
4. The MONICA collaboration did not require simultaneous recording of coronary care across the MONICA populations. However, comparison of G11 with G10 shows greater uniformity in timing across populations for coronary care than there was for the population risk-factor surveys.
5. The lapse of time between the first and second period differed in different populations. The improvements in treatment between the two periods in different populations (See G57–G68) are specific to those periods and the variable distance between them, as are the associated changes in coronary-event rates. Differences in treatment and in event rates in the same population RUA can be considered together because they are matched for time difference. If either the changes in treatments or the changes in end-point rates are compared across population RUAs, the lack of standardization of the time differences might lead to wrong conclusions.

1. See [Monograph CD-ROM or MONICA Website http://www.ktl.fi/monica/](http://www.ktl.fi/monica/).
2. Full references and summaries of MONICA Publications appear in #85/86.

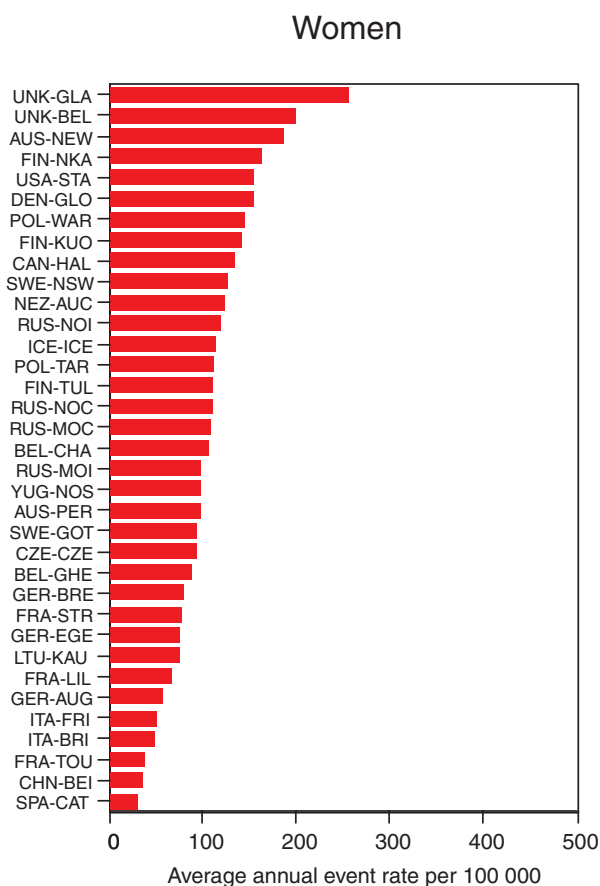
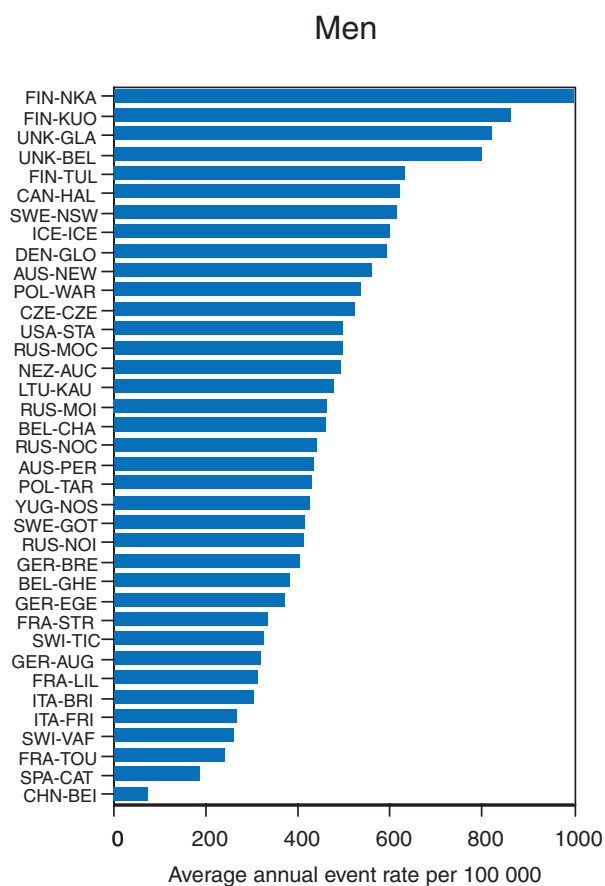
## G11 Periods used for testing the MONICA coronary-care (treatment or second) hypothesis



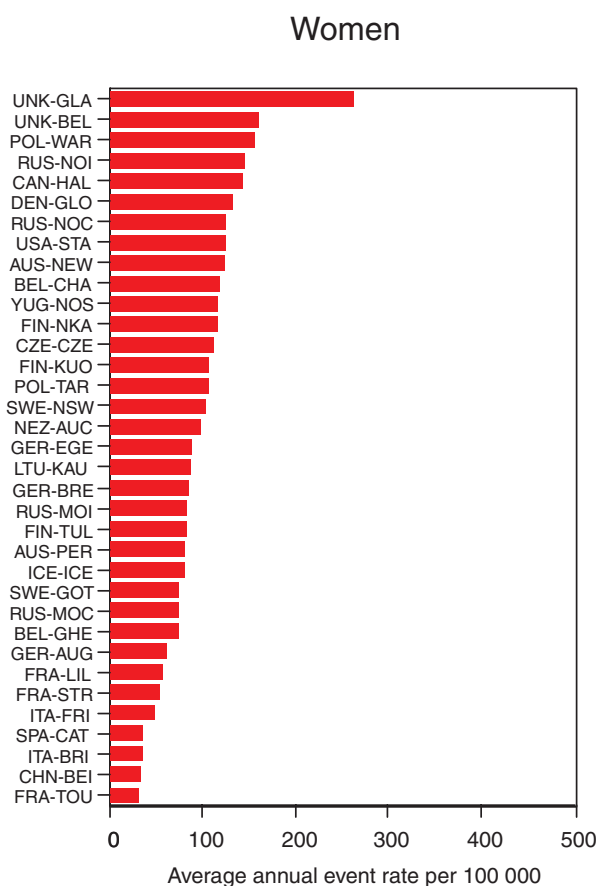
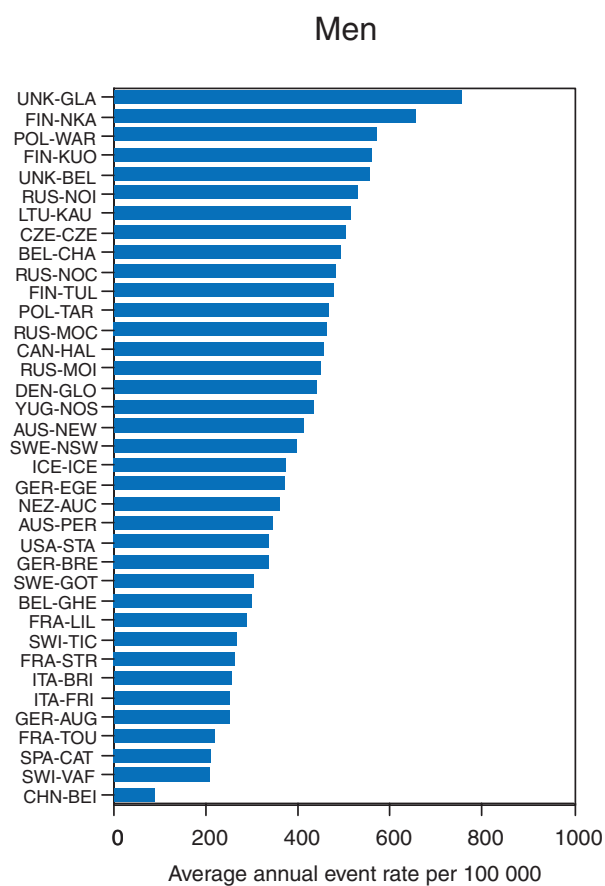
## Coronary events: incidence, case fatality and mortality rates

1. The specific calendar years included in the two three-year periods differed by population. They were identified previously in G8.
  2. Event rates are calculated using registration data for events, and demographic data for population denominators. See #17 *Demographic Data*, #37 *Event Rates, Case Fatality, and Trends*, MONICA Quality assessment of demographic data (1), MONICA Quality assessment of coronary-event registration data (1), MONICA Data Book of coronary events (1).
  3. Results are age-standardized for the 35–64 age group, using the world standard population. See #39 *Age Standardization*.
  4. Coronary events are defined using MONICA diagnostic criteria. In this case definition 1 is used, incorporating definite non-fatal myocardial infarction and definite, possible and unclassifiable (previously called ‘insufficient data’) coronary deaths. Non-fatal possible myocardial infarction is excluded from this definition. See #23 *Diagnosing Myocardial Infarction and Coronary Death*, MONICA Manual Part IV, Section 1 (1), and MONICA Publication 16 (2).
  5. Note that the scale maximum for women on the x-axis is half of that for men.
  6. Confidence intervals, an indicator of precision, are not shown. Rates are averaged over three years, involving large numbers of events in most populations. Estimates of rates should therefore be reasonably precise. See the MONICA Data Book of coronary events, table 6 (1), for numbers.
  7. These figures illustrate the five-to-one and ten-to-one variation in event rates between populations of the same sex, and the four to one ratio between coronary-event rates in men and women. Comparison of G13 with G12 shows the changes of coronary-event rates over time and resulting change in population RUA rankings.
1. See **Monograph CD-ROM or MONICA Website** <http://www.ktl.fi/monica/>.
  2. **Full references and summaries of MONICA Publications appear in #85/86.**

## G12 Coronary-event rates: first three years of registration



## G13 Coronary-event rates: final three years of registration



## G14

1. For calculating the trends in population coronary-event rates in MONICA we use a statistical model that assumes that each trend is log-linear in pattern, and that expresses the result as annual percentage change. See #37 *Event Rates, Case Fatality, and Trends*. Graph G14 shows annual event rates before any statistical modelling has been done. Although largely unreadable it is there because it illustrates the problems in the raw data before the statistical model is used. There are large year-on-year fluctuations. Trends in event rates in specific populations may not appear linear, but J-, or U-shaped. A large absolute difference where rates are high will be equivalent, in percentage terms, to a smaller one in different population RUAs where the underlying rate is low.
2. G14 does show a general pattern of decline, but also what is happening at the extremes. Results for Finland-North Karelia, FIN-NKA, see #58, in men and United Kingdom-Glasgow, UNK-GLA, see #81, in women are notable at the top end of the distribution. China-Beijing, CHN-BEI, see #55, in men and Spain-Catalonia, SPA-CAT, see #76, in women have the lowest rates. Yearly numbers of coronary events, and coronary-event rates are published in the MONICA Data Book of coronary events, table 6 (1) from which this graph is derived.
3. Note in G14 the difference in scale maximum on the y-axis between men and women. It is almost four-to-one.

## G15

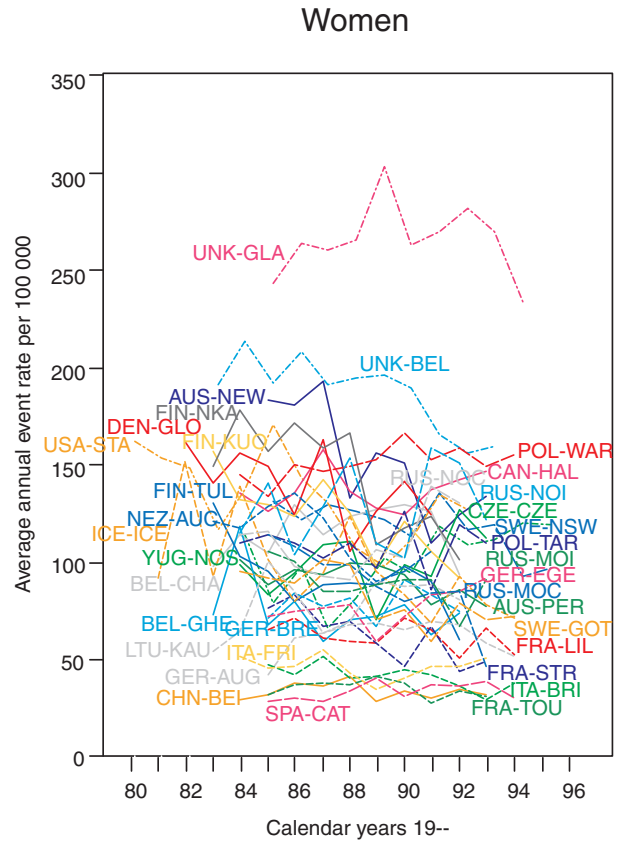
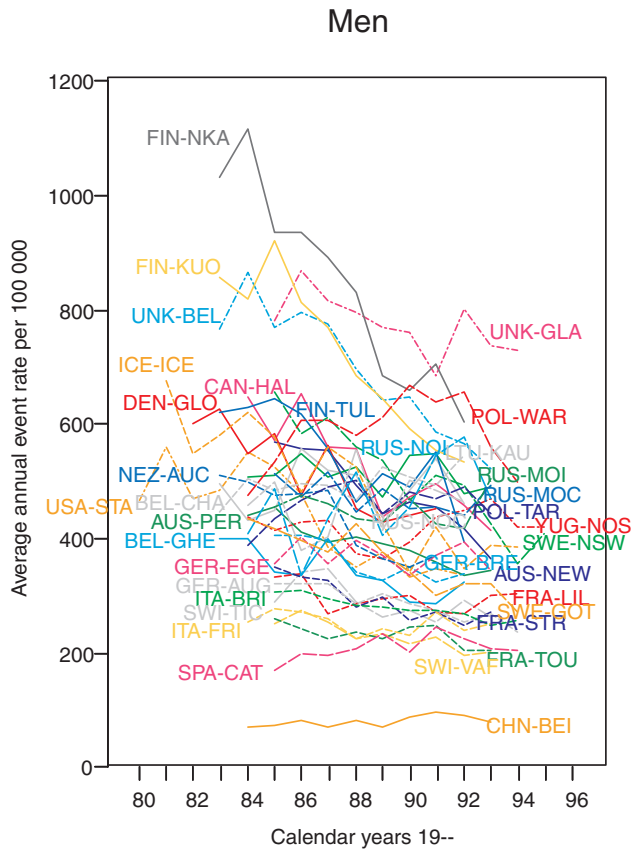
4. G15 is derived from the same set of data as G14, but after calculation of trends. See #37 *Event Rates, Case Fatality and Trends*. It is partly coincidental and not inevitable that the extreme values are held by almost the same population RUAs in men in G14 and G15 (Finland-North Karelia, FIN-NKA and China Beijing, CHN-BEI). G14 is plotted for rates, low to high, and G15 for trends in rates, decreasing to increasing. The same pattern is not seen in women, where there is no association between extremes in rates and extremes in trends.

5. Horizontal bars in G15 show the 95% confidence intervals around the estimated annual trend. The smaller the length of the bars the more precise the estimated trend. If the bars fail to cross the zero line the estimated trend is considered to deviate significantly from zero. This graph follows a standard model used for presenting estimated trends in the MONICA results. Declining trends are shown to the left of the zero line, and increasing trends to the right.
6. Confidence intervals are wider for women than for men because there were fewer events. Greater relative year-on-year fluctuations, through the random variation resulting from smaller numbers, are seen well in G14 when the two sexes are compared. This resulted in less precise estimates of trends in women in G15 than in men. Wide confidence intervals are also found where the trend appears to deviate from log-linear.
7. Both G14 and G15 show that the tendency in the majority of MONICA population RUAs is towards a decline in coronary-event rates. In this majority in G15 the estimated annual trend is to the left of the zero line. In men the ratio is four-fifths declining versus one-fifth increasing. In women it is nearer to two-thirds declining to one-third increasing. See the same data presented also in G23, G24 and G25.
8. G15 was previously published in MONICA Publication 36 (2). It was important in establishing that there were differing trends in coronary-event rates (rates when non-fatal and fatal coronary events were combined), in the different MONICA population RUAs around the world. The data previously available for multinational comparisons were from routine death certification.

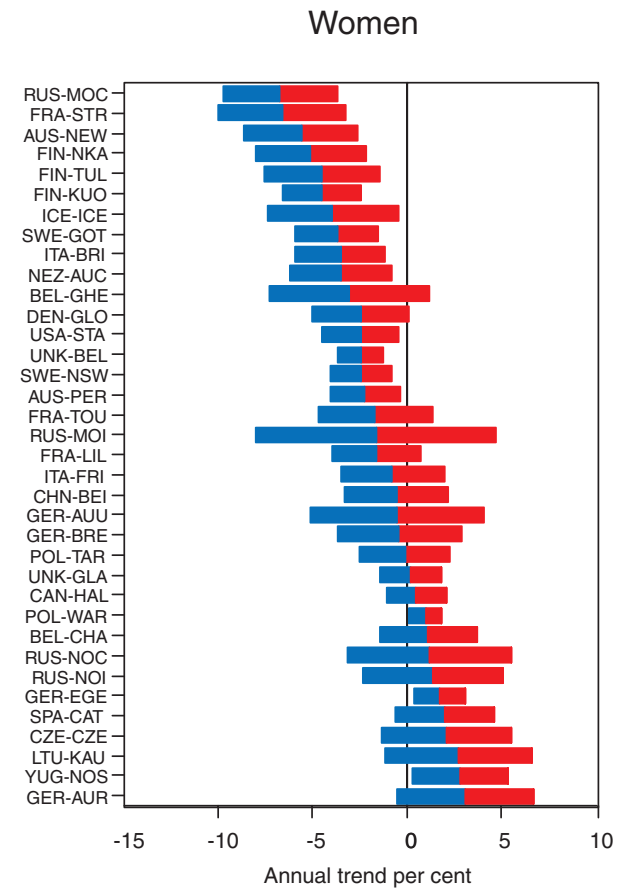
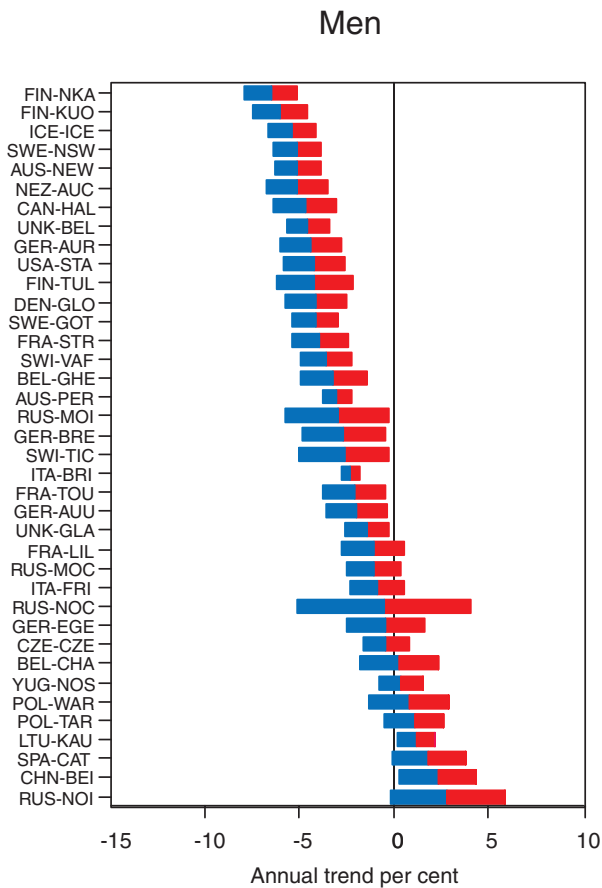
1. See [Monograph CD-ROM](#) or [MONICA Website <http://www.ktl.fi/monica/>](#).
2. [Full references and summaries of MONICA Publications appear in #85/86.](#)



## G14 Coronary-event rates by calendar year of registration



## G15 Average annual change in coronary-event rates

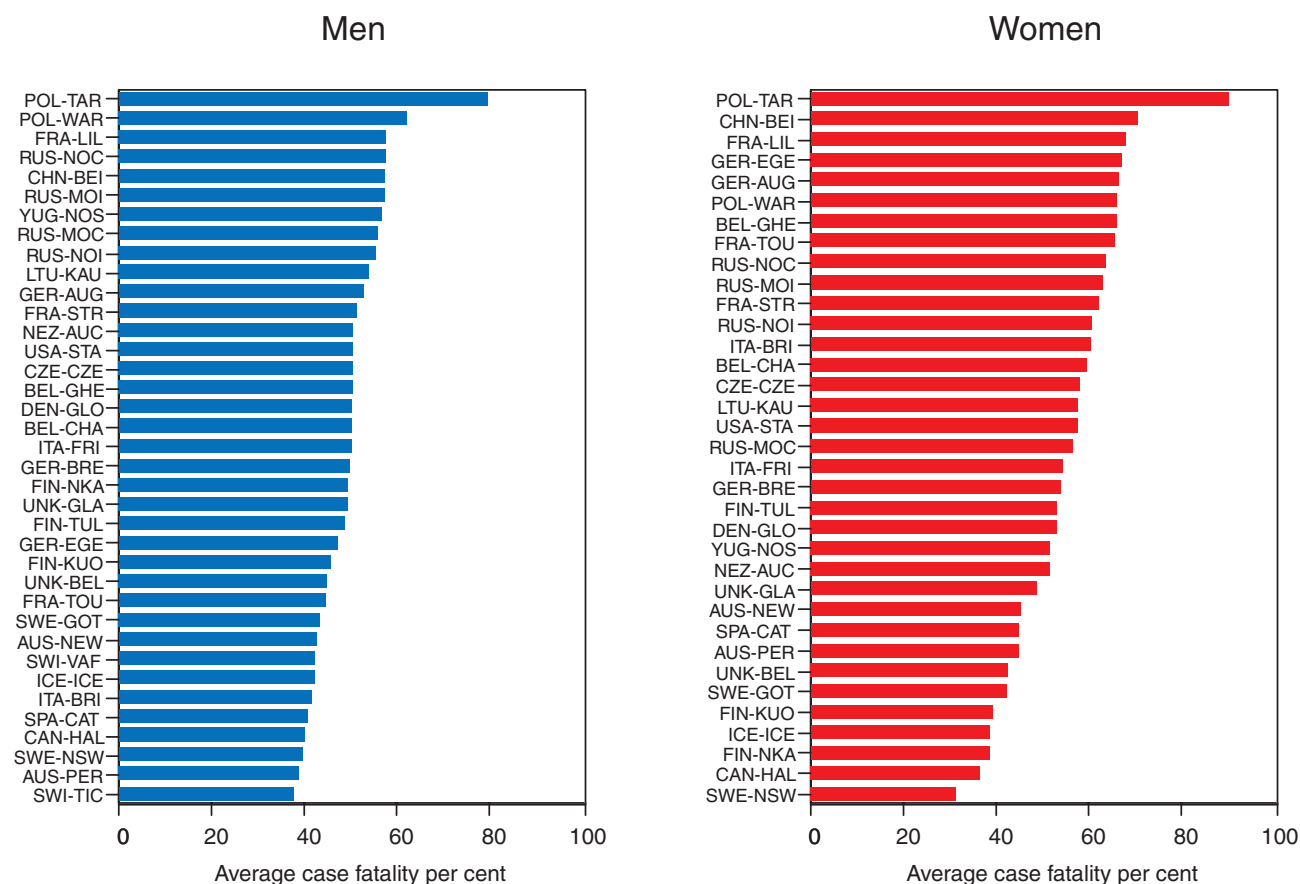


*Notes in italics are repeated to help random browsers—systematic readers should ignore them*

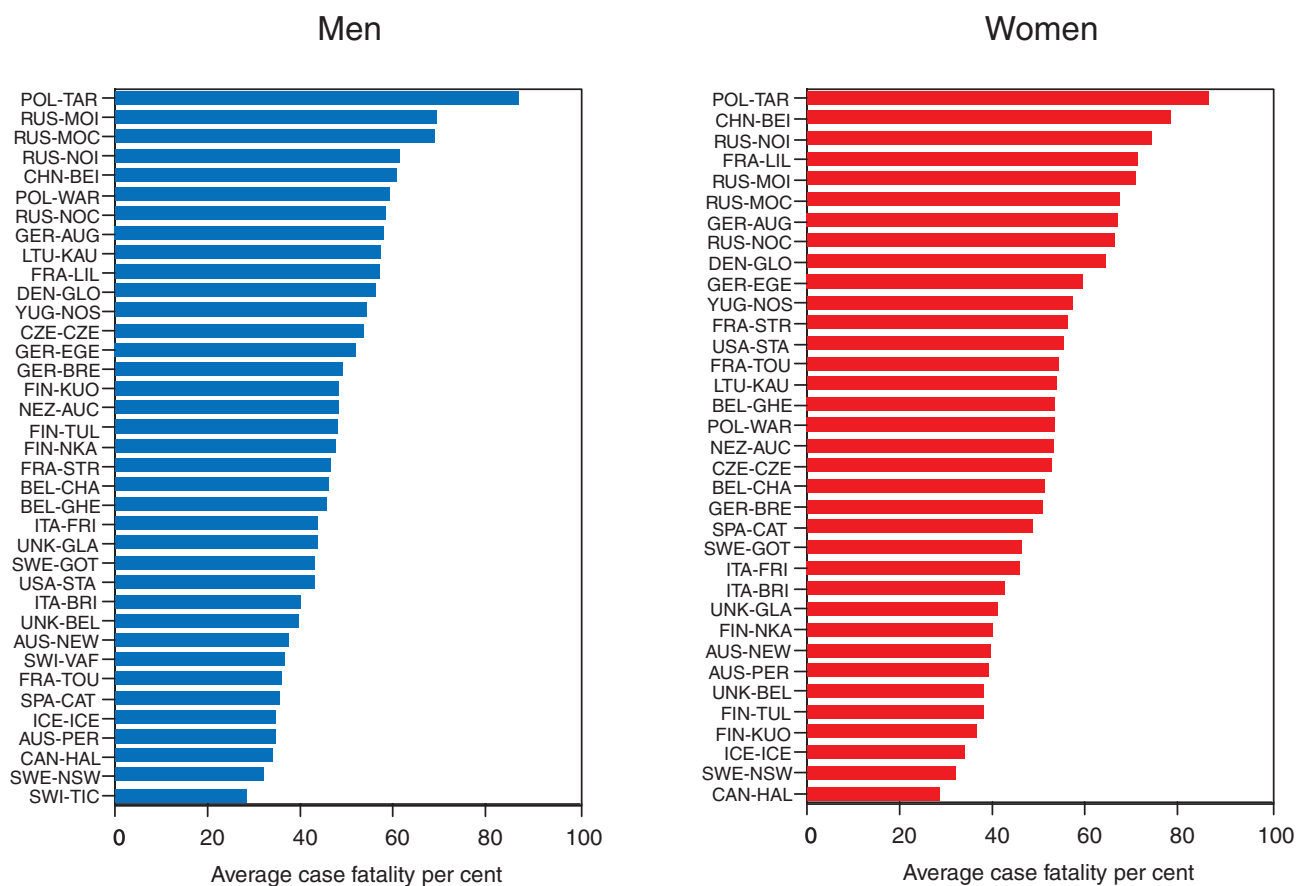
1. *The specific calendar years included in the two three-year periods differed by population. They were identified in G8.*
2. Case fatality is the proportion of events ending fatally within 28 days from the onset of the attack. See #37 *Event Rates, Case Fatality, and Trends*.
3. The denominator is all events so the scale is the same for men and women. Case fatality does not involve population demographic data.
4. Results are age-standardized for the 35–64 age group, using the MONICA weightings for case fatality. See #39 *Age Standardization*.
5. *The case fatality here is for coronary events defined using MONICA diagnostic criteria, definition 1. Definition 1 incorporates definite non-fatal myocardial infarction and definite, possible and unclassifiable (previously called ‘insufficient data’) coronary deaths. Non-fatal possible myocardial infarction is excluded from this definition. See #23 *Diagnosing Myocardial Infarction and Coronary Death, MONICA Manual Part IV, Section 1 (1), and MONICA Publication 16 (2)*.*
6. Case fatality here is higher than that in published clinical case series of myocardial infarction. Results include all coronary deaths, two-thirds or more of which occur before admission to hospital. Clinical case series usually start with diagnosed patients’ admission to hospital and exclude coronary deaths in patients admitted for other conditions. That is why the case fatality is much lower. Follow-up may cease at hospital discharge or at three weeks rather than the 28 days in MONICA, but that has a smaller impact on case fatality than that from exclusion of pre-hospital sudden deaths. See MONICA Publications 16, 29 (2).
7. The complement of case fatality, survival, should relate to treatment. Fatality and survival also reflect the relative success of the MONICA registers in finding and confirming putative fatal and non-fatal coronary cases. This problem is discussed in MONICA Publications 16, 29, 36 (2).
8. High case fatality, as in Poland-Tarnobrzeg Voivodship, POL-TAR, see #72, reflects delays and difficulties in obtaining diagnostic confirmation of non-fatal events, to make them definite myocardial infarction. Without early electrocardiographic or serological confirmation, all potential definite non-fatal cases are classified as possibles, and excluded from the case mix for MONICA definition 1. See #23 *Diagnosing Myocardial Infarction and Coronary Death, MONICA Manual Part IV, Section 1 (1), and MONICA Publication 16 (2)*.
9. *Confidence intervals, an indicator of precision, are not shown. Rates are averaged over three years, involving large numbers of events in most population. Estimates of case fatality should therefore be reasonably precise. See MONICA Data Book of coronary events, table 6 (1) for the numbers.*
10. These figures illustrate the variation between populations, and between the two sexes, and changes in ranking over time. On average, case fatality was slightly higher in women than in men. Differences were usually small, and were absent in some populations with high coronary-event rates in both sexes. This question is examined in MONICA Publications 16, 29, 36 (2). MONICA Publication 16 showed that high case fatality in women, but not in men, correlated with low population event rates. The authors suggested that this might result from a lower level of suspicion, recognition and ascertainment of myocardial infarction in women patients with non-fatal infarction compared to that in men. MONICA Publication 39 (2) discussed trends in case fatality in relation to changes in treatment, examining the Second MONICA Hypothesis. Graphs G16 and G17 show some suggestive geographical polarization between populations with low and high case fatality.

1. See **Monograph CD-ROM or MONICA Website** <http://www.ktl.fi/monica/>.
2. **Full references and summaries of MONICA Publications appear in #85/86.**

## G16 Case fatality for coronary events: first three years of registration



## G17 Case fatality for coronary events: final three years of registration



*Notes in italics are repeated to help random browsers—systematic readers should ignore them*

### G18

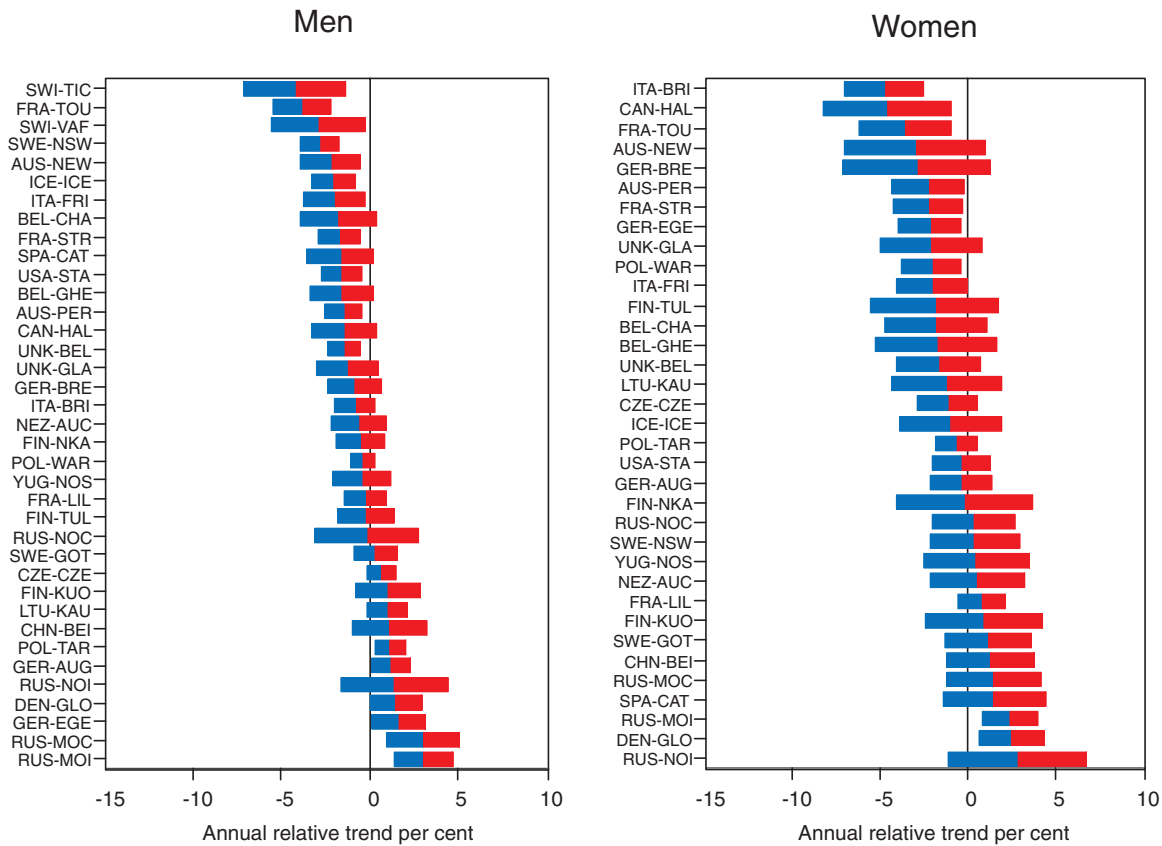
1. Calculation of trends is explained in #37 *Event Rates, Case Fatality and Trends*. The units of change in case fatality are potentially confusing because its basic unit is per cent, so that a percentage decline can be interpreted as absolute or relative. (Similarly potential confusion arises later for changes in cigarette smokers (see G37).) Because of an important mathematical relationship (see later, G23) the trend shown here is the relative trend. Case fatality averages about 50% overall. If it declined from 50% to 49% the relative decline would be about 2%, as shown in G18, but the absolute change would be 1%.
2. *Horizontal bars in G18 show the 95% confidence intervals around the estimated annual trend. The smaller the length of the bars the more precise the estimated trend. If the bars fail to cross the zero line the estimated trend is considered to deviate significantly from zero. Declining trends are shown to the left of the zero line, and increasing trends to the right.*
3. *Confidence intervals are wider for women than for men because there were fewer events. Greater year-on-year fluctuations through the random variation resulting from smaller numbers resulted in less precise estimates of trends. Wide confidence intervals are also found where the trend appears to deviate from log-linear.*
4. G18 shows that case fatality is tending downwards in most populations in MONICA, although the estimated trend in many individual results fails to differ significantly from zero. The crossover point in the graph for men is slightly lower down than that in the graph for women, but in both there is close to two-thirds of populations with an estimated decline and one-third with an increase. This graph has been published previously in MONICA Publication 36 (2).

### G19

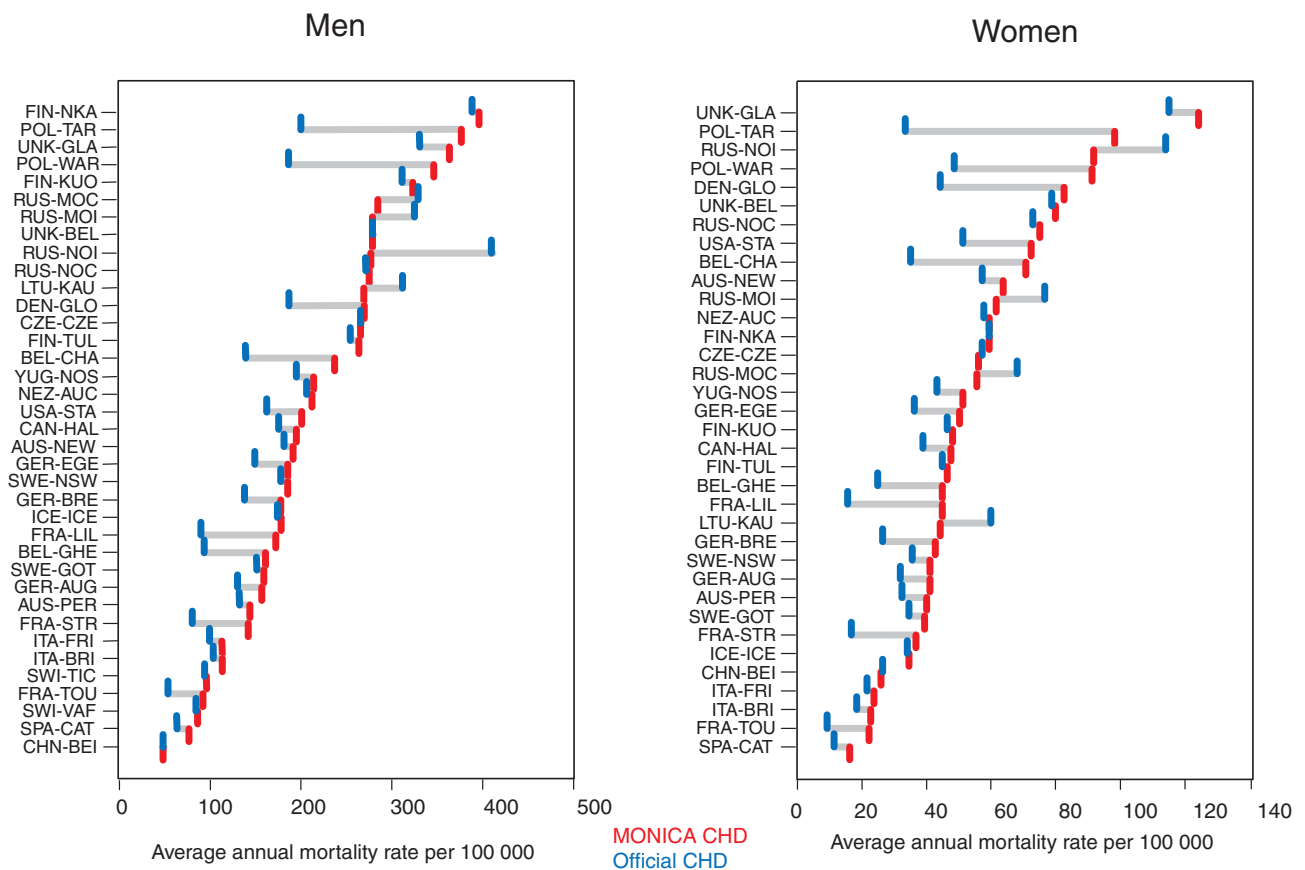
5. G19 contrasts the results of comparing mortality rates, calculated from two sources: firstly from numbers of MONICA coronary heart disease (CHD) deaths validated through registration, and secondly from numbers of coronary deaths reported by routine official sources. See #16 *Routine Mortality Data*. The same population denominators were used to calculate both event rates. There are substantial discrepancies in some populations but not all, suggesting both potential under-reporting and over-reporting of coronary deaths. A dilemma posed by the discrepancy is whether to include as coronary deaths those that MONICA found unclassifiable—deaths with no available diagnostic information (originally labelled ‘insufficient data’). These accounted for 22% of potential coronary deaths overall, and over 40% in some populations. This graph uses MONICA case definition 1, including unclassifiable deaths. MONICA definition 2, which excludes them, gives a different result. The answer may be somewhere between. See #23 *Diagnosing Myocardial Infarction and Coronary Death*, MONICA Manual Part IV, Section 1 (1), MONICA Publications 16 (2) (which examines this issue in detail) and 36 (2).
6. In G19 the scale maximum for men and women is different on the x-axis, that for men being three-and-a-half times greater than for women. Discrepancies between MONICA and official CHD mortality rates in women are proportionately greater than those in men.
7. G19 gives an impression of what is happening across populations, but is less easy to read for single populations. The grey line joining the red and blue marks indicates the extent of the discrepancy. Basic information on which G19 is based is found in the MONICA Data Book of coronary events, table 11 (1). Five year cross-sectional data were published in MONICA Publication 16 (2).

1. See [Monograph CD-ROM or MONICA Website http://www.ktl.fi/monica/](http://www.ktl.fi/monica/).
2. Full references and summaries of MONICA Publications appear in #85/86.

## G18 Average annual change in case fatality



## G19 Populations ranked by ten-year average MONICA coronary heart disease (CHD) mortality rates showing official unvalidated rates



*Notes in italics are repeated to help random browsers—systematic readers should ignore them*

## G20

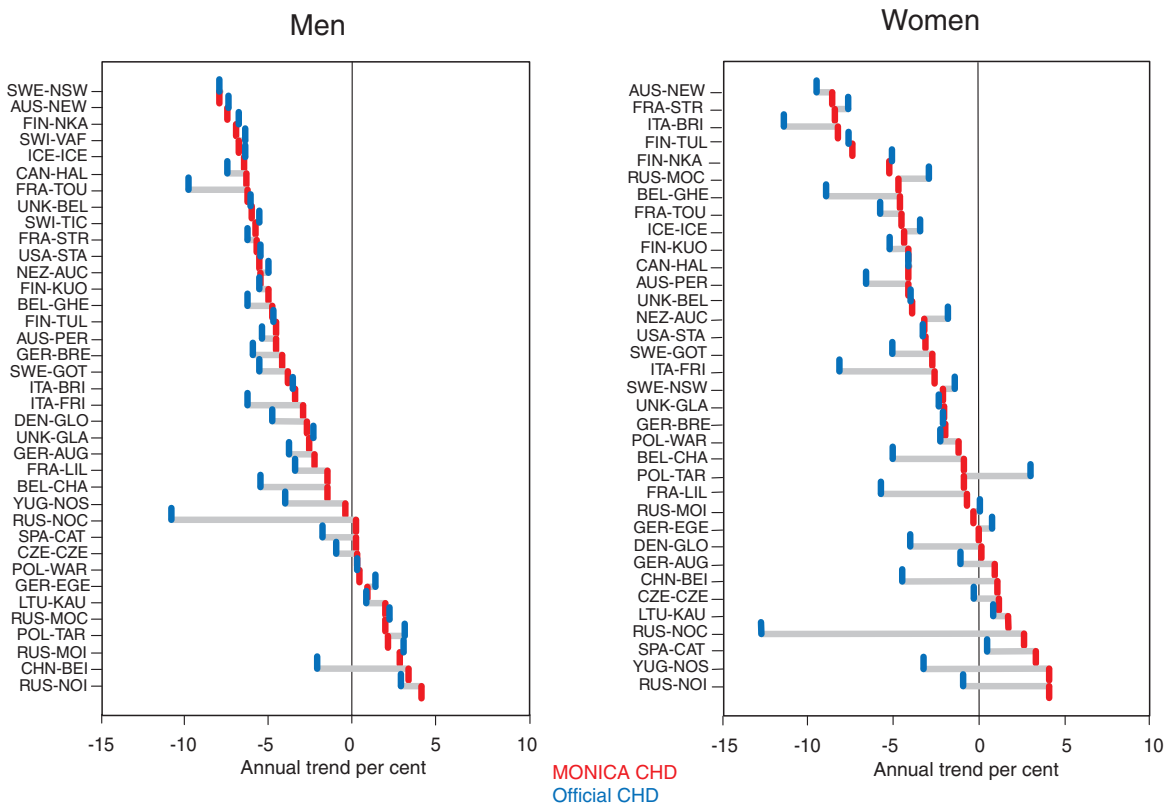
1. *Calculation of trends is explained in #37 Event Rates, Case Fatality, and Trends.*
2. G20 follows on from G19 (see earlier commentary), showing trends over time in the same data components. The original data are found in table 11 of the MONICA Data Book of coronary events (1).
3. In men, trends in MONICA CHD mortality rates are often more modest than those in the official mortality rates. However, there is better agreement between the estimated *trends* in official and MONICA CHD mortality rates in G20 in men, than there is for the *mortality rates themselves* in G19.
4. There is relatively less agreement between the two mortality trends in women than there is in men.
5. There are several explanations for the discrepancies, not all implying that MONICA is right. Was registration of events uniformly complete over time? Did the proportion of unclassifiable coronary deaths change over time (see notes for G19)? Did the medico-legal practice in sudden death change, for example for post-mortem examination? See MONICA Quality assessment of coronary event registration data table 8 (1), MONICA Data Book of coronary events table 5 (1), for further information.
6. G20 answers one of the original MONICA questions. When MONICA was planned during the late 1970s and early 1980s there were still many eminent pathologists and cardiologists who denied that mortality rates for coronary heart disease were changing. They claimed that the reported declines were spurious and resulted from changing fashions and inaccuracies in death certification. MONICA discovered numerous problems and discrepancies in death certification, but confirmed that mortality rates from cardiovascular disease were indeed changing.

## G21

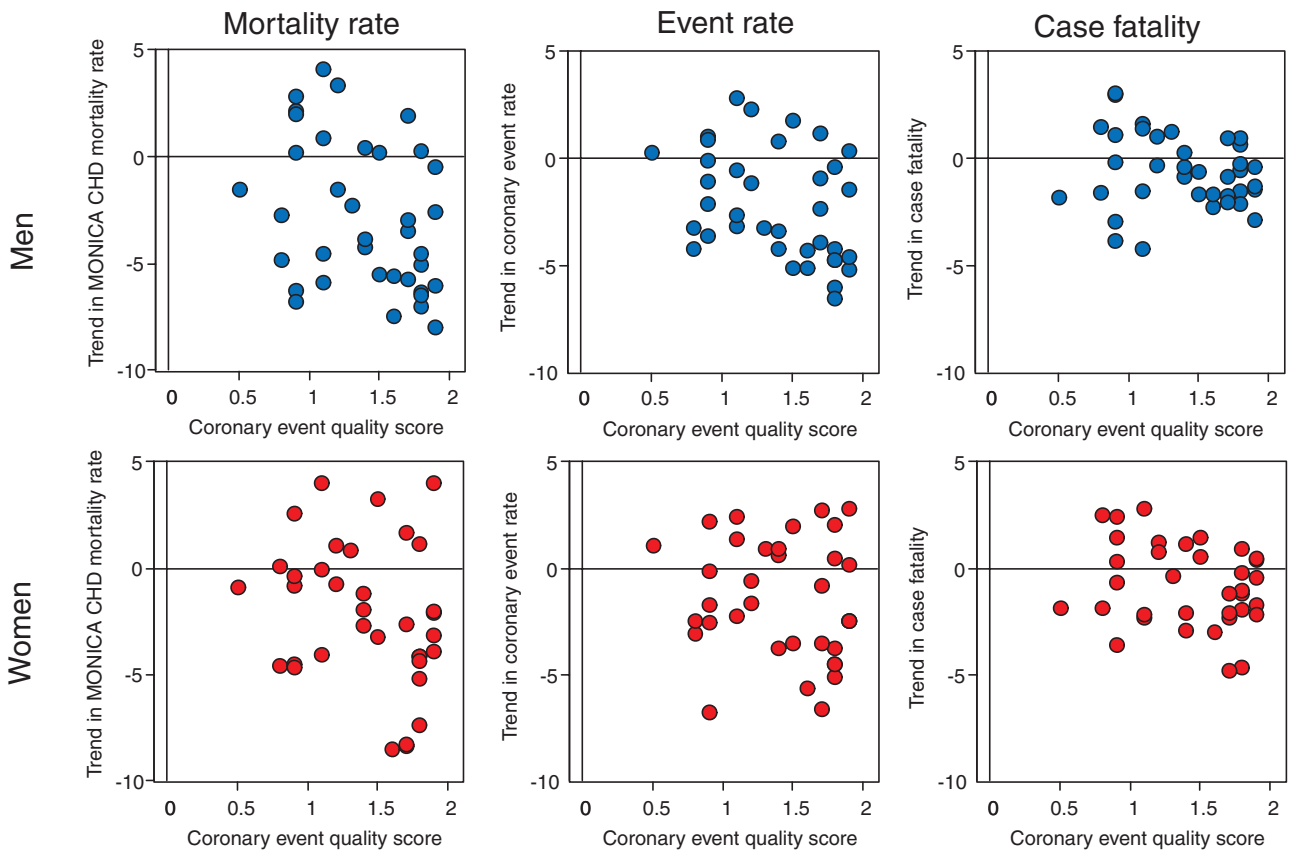
7. A recurrent concern in MONICA analyses is whether extreme results, or indeed the general pattern of results, could be unduly influenced by variations in the quality of data. Quality assessment was rigorous, the results are explicit, are published on the Web, and are taken into consideration in the major analyses. See MONICA Quality assessment of coronary event registration data (1) MONICA Quality assessment of demographic data (1).
8. In G21 the relation between trends in coronary end-points, and the quality score allocated to each population for its coronary-event data is not random. The weak relation that is there is shown on formal calculation not to be strong enough to suggest that study results were significantly compromised or confounded by known variation in data quality. See MONICA Quality assessment of coronary event registration data, Appendix 5—Coronary events trends quality scores (1), MONICA Publication 36 (2).

1. See [Monograph CD-ROM or MONICA Website http://www.ktl.fi/monica/](http://www.ktl.fi/monica/).
2. Full references and summaries of MONICA Publications appear in #85/86.

**G20 Populations ranked by average annual change in MONICA CHD mortality rates, showing unvalidated (from routine mortality reporting) trend equivalents**



**G21 Change in coronary end-points, by population, against coronary-event quality score**



*Notes in italics are repeated to help random browsers—systematic readers should ignore them*

## **G22**

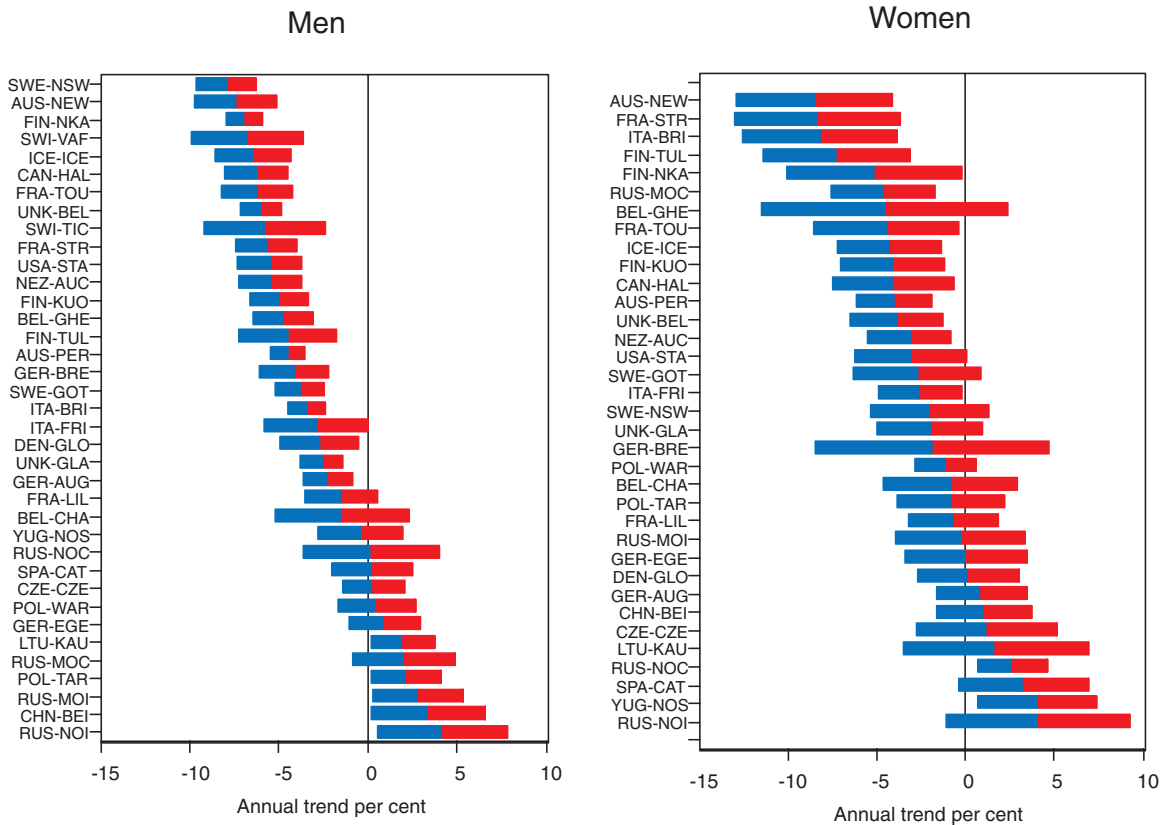
1. *Calculation of trends is explained in #37 Event rates, Case Fatality, and Trends.*
2. *Horizontal bars in G22 show the 95% confidence intervals around the estimated annual trend. The smaller the length of the bars the more precise the estimated trend. If the bars fail to cross the zero line the estimated trend is considered to deviate significantly from zero. Declining trends are shown to the left of the zero line, and increasing trends to the right.*
3. *Confidence intervals are wider for women than for men because there were fewer events. Greater year-on-year fluctuations through the random variation resulting from smaller numbers resulted in less precise estimates of trends. Wide confidence intervals are also found where the trend appears to deviate from log-linear.*
4. G22 shows that MONICA CHD mortality rates are decreasing in most populations in MONICA, although many individual trends do not deviate significantly from zero. The proportion of populations in which there is an increasing trend, about one-third, is similar in the two sexes.

## **G23**

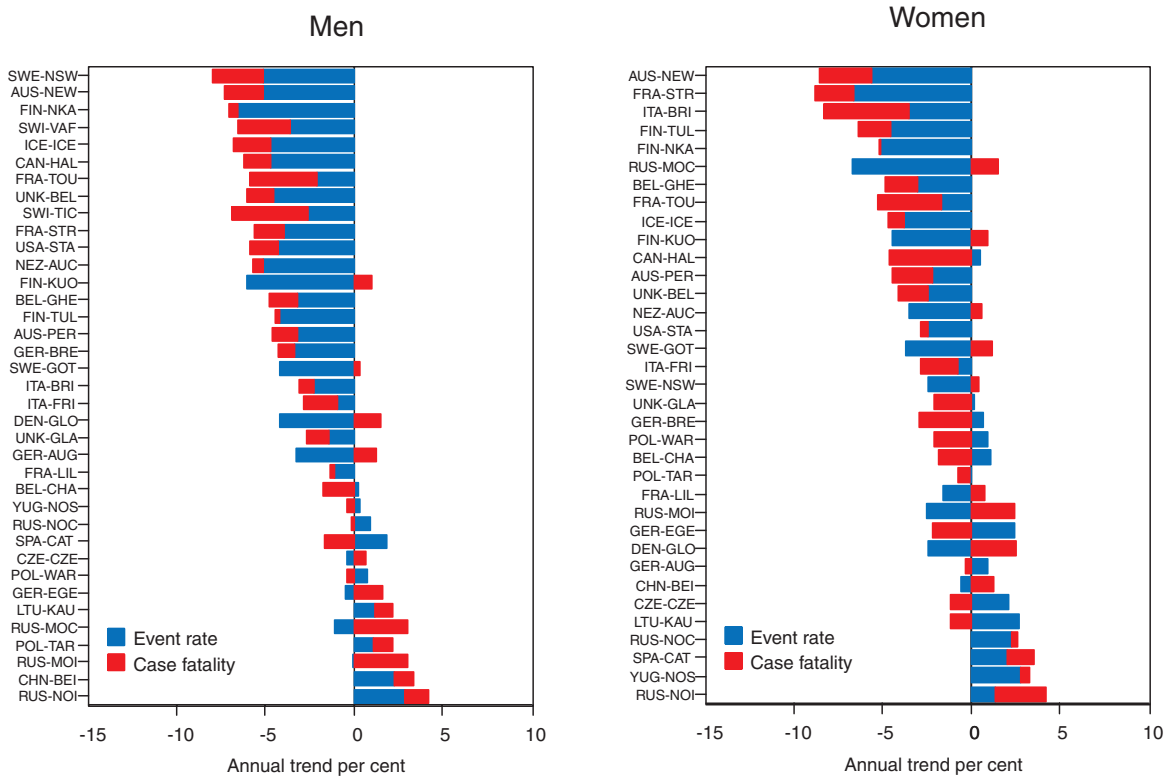
5. It can be shown mathematically that changes in MONICA CHD mortality rates are the sum of change in coronary-event rates and relative change in case fatality. G23 plots the ranking of change in CHD mortality rates (already shown in G22 with confidence intervals) but this time as the sum of the two contributing components. See #37 *Event Rates, Case Fatality, and Trends*. The overall pattern is for trends in coronary-event rates to explain about two-thirds of the change in CHD mortality rates. Change in case fatality (which is the complement of survival) explains the remaining third.
  6. G23 was published in the first major MONICA collaborative paper of final results, MONICA Publication 36 (2). G23 shows a key finding of the MONICA Project—that during the mid-1980s to mid-1990s, the decline in mortality rates from coronary disease in MONICA populations resulted more from a falling incidence of disease than from better survival in those affected, although improvement in the latter was significant. Other studies have produced contradictory results, but none of them matched the number of populations and years involved in MONICA.
- 2. Full references and summaries of MONICA Publications appear in #85/86.**



## G22 Average annual change in MONICA coronary heart disease (CHD) mortality rates

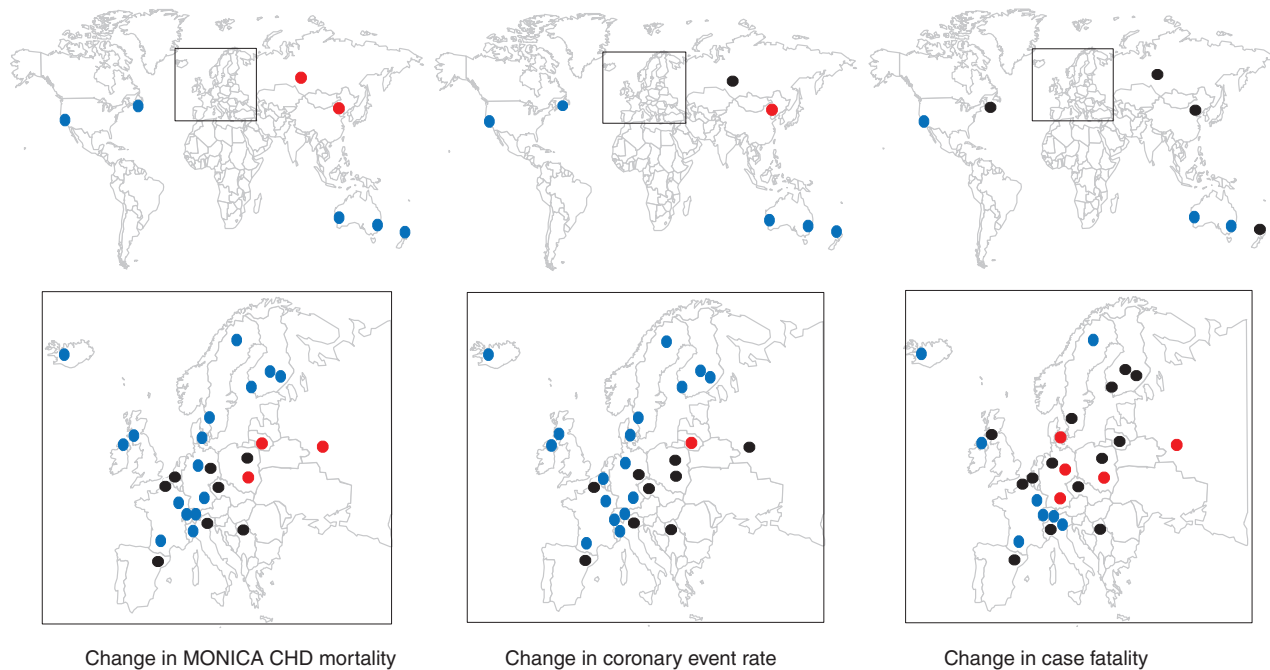


## G23 Changes in MONICA coronary heart disease (CHD) mortality rates divided between changes in coronary-event rates and changes in case fatality



1. G24 and G25 summarize the results shown for trends in mortality in G22, for trends in coronary-event rates in G15, and for trends in case fatality in G18. The Russia-Moscow (RUS-MOS, MOC/MOI, #74) and Russia-Novosibirsk (RUS-NOV, NOC/NOI, #75) populations were split in the previous graphs, but here they feature as single RUAs, with single spots.
2. A blue spot indicates a population RUA whose estimated trend and confidence intervals for that endpoint are to the left of the zero line in the relevant graph indicating a significant decline.
3. Red spots indicate population RUAs whose estimated trends and confidence intervals are to the right of the zero line, showing significant increases.
4. Black spots indicate populations where confidence intervals straddle the zero line, so that trends are not significantly different from zero, even though the trend estimate itself may be to one side of it, as is usually the case.
5. There are more black spots in women, G25, than in men, G24, because estimated trends are less precise, with greater confidence intervals, even though the estimated trends themselves are often as large as those in men.
6. The European and world maps suggest clustering of populations with similar trends in coronary endpoints, shown by the distribution of spots of the same colour.

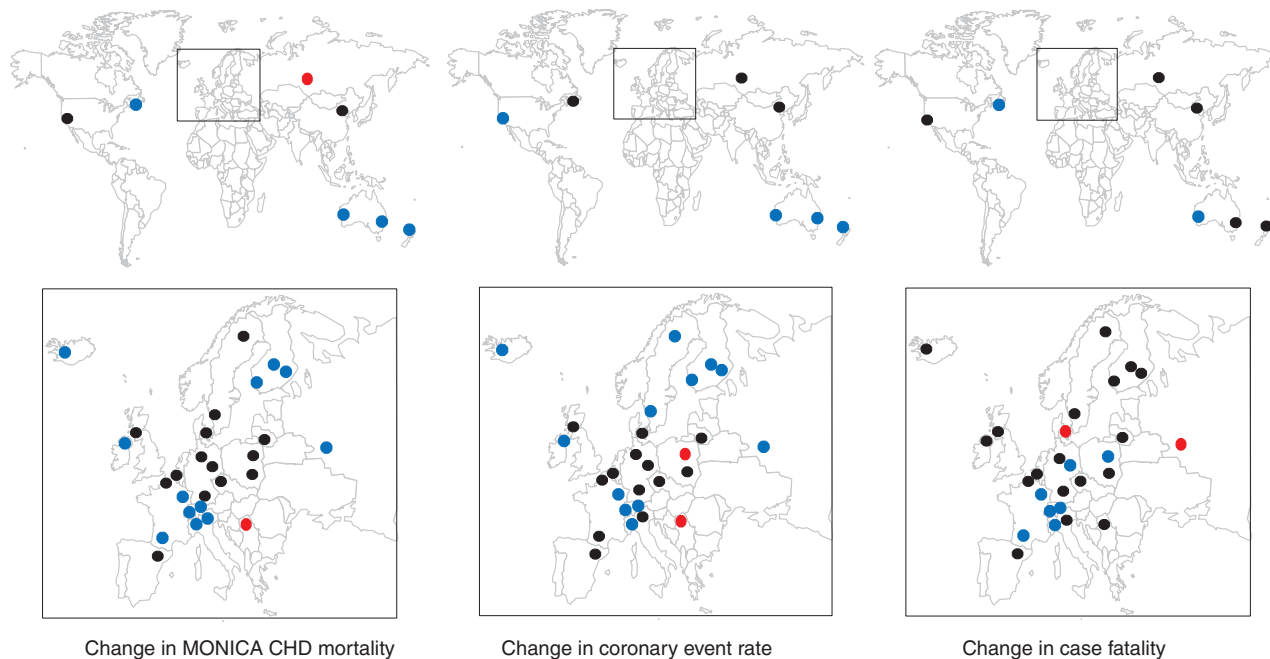
## G24 Spot maps of changes in coronary end-points in men



Significant increase  
 Insignificant change  
 Significant decrease

Men

## G25 Spot maps of changes in coronary end-points in women



Significant increase  
 Insignificant change  
 Significant decrease

Women

## Strokes: incidence, case fatality and mortality rates

1. The specific calendar years included in the two three-year periods differed by population. They were identified in G9, and were not necessarily the same as those used for coronary-event registration.
2. Event rates are calculated using registration data for events, and demographic data for population denominators. See #17 *Demographic Data*, #37 *Event Rates, Case Fatality, and Trends*, MONICA Quality assessment of demographic data (1), MONICA Quality assessment of stroke registration data (1), MONICA Data Book of stroke events (1).
3. Results are age-standardized for the 35–64 age group, using the world standard population. See #39 *Age Standardization*.
4. Strokes are defined using MONICA diagnostic criteria. The criterion for stroke itself is the clinical presentation: symptoms, signs and clinical examination. Stroke does not have simple confirmatory tests equivalent to the electrocardiogram and cardiac enzyme tests used to define definite myocardial infarction, but there was increasing use of imaging techniques over the registration period, which were used to identify what sort of stroke had occurred. The cerebrovascular disease in stroke can be haemorrhage from an artery (subarachnoid haemorrhage, or intracerebral haemorrhage) or ischaemia from atheromatous arterial thrombosis leading to infarction or death of part of the brain (atherothrombotic cerebral infarction). See #26 and #27 *Registration of Stroke Events, Diagnosis of Stroke*, MONICA Manual Part IV, Section 2 (1), MONICA Publications 5, 18, 19, 21. (2).
5. Confidence intervals, an index of precision, are not shown. Rates are averaged over three years. They are less precise than those for coronary events in men and more similar to those in women. See MONICA Data Book of stroke events, table 5.1 (1) for numbers of events from which these rates are derived.
6. These figures show: a four-fold variation in rates across populations in men and six-fold variation in women; on average higher event rates in men than women within populations; the changes in population event rates over time; and the effects of these changes on the population rankings.

### G27

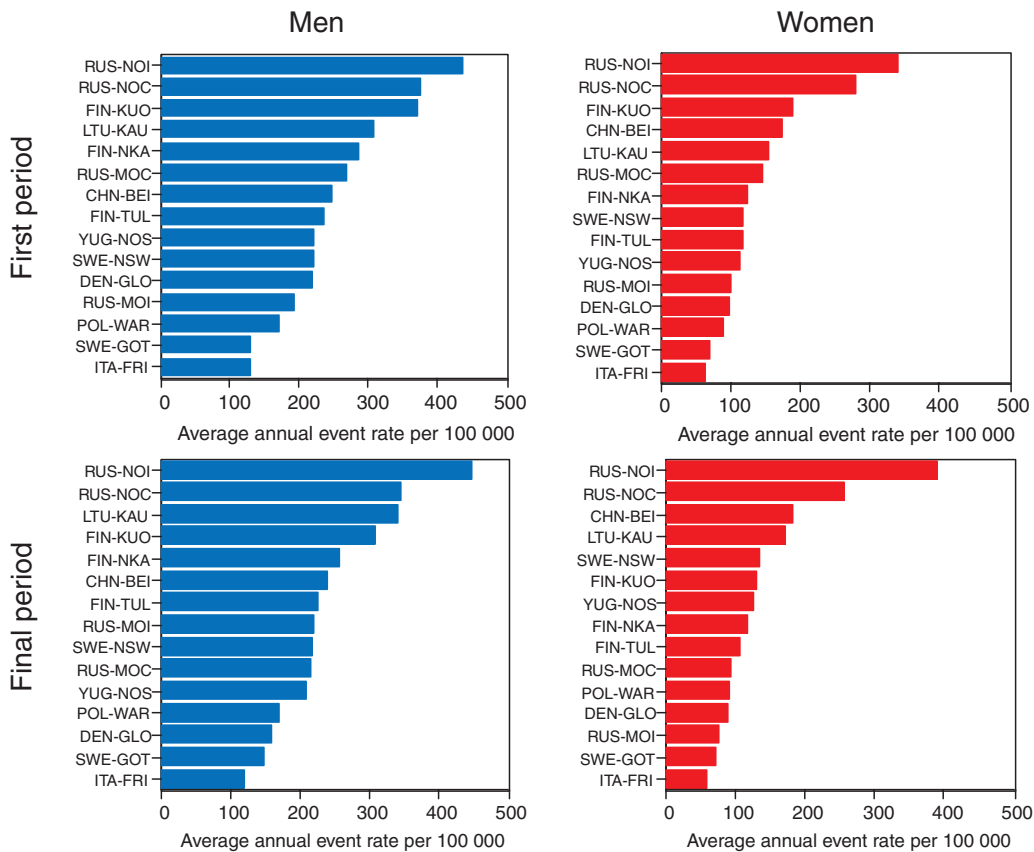
8. The lower graph, G27 is unreadable for some populations but deliberately inserted to show what the annual trend data look like before summarizing them statistically in terms of log-linear trends, shown in G29. (See the discussion for G14.) G27 gives an overall picture of the trends over time. Among the year-on-year fluctuations some populations seem to show a decline in rates but others little change. Yearly numbers and rates are available in the MONICA Data Book of stroke events, table 5.1 (1), from which this graph is derived.

1. See **Monograph CD-ROM or MONICA Website** <http://www.ktl.fi/monica/>.
2. **Full references and summaries of MONICA Publications appear in #85/86.**

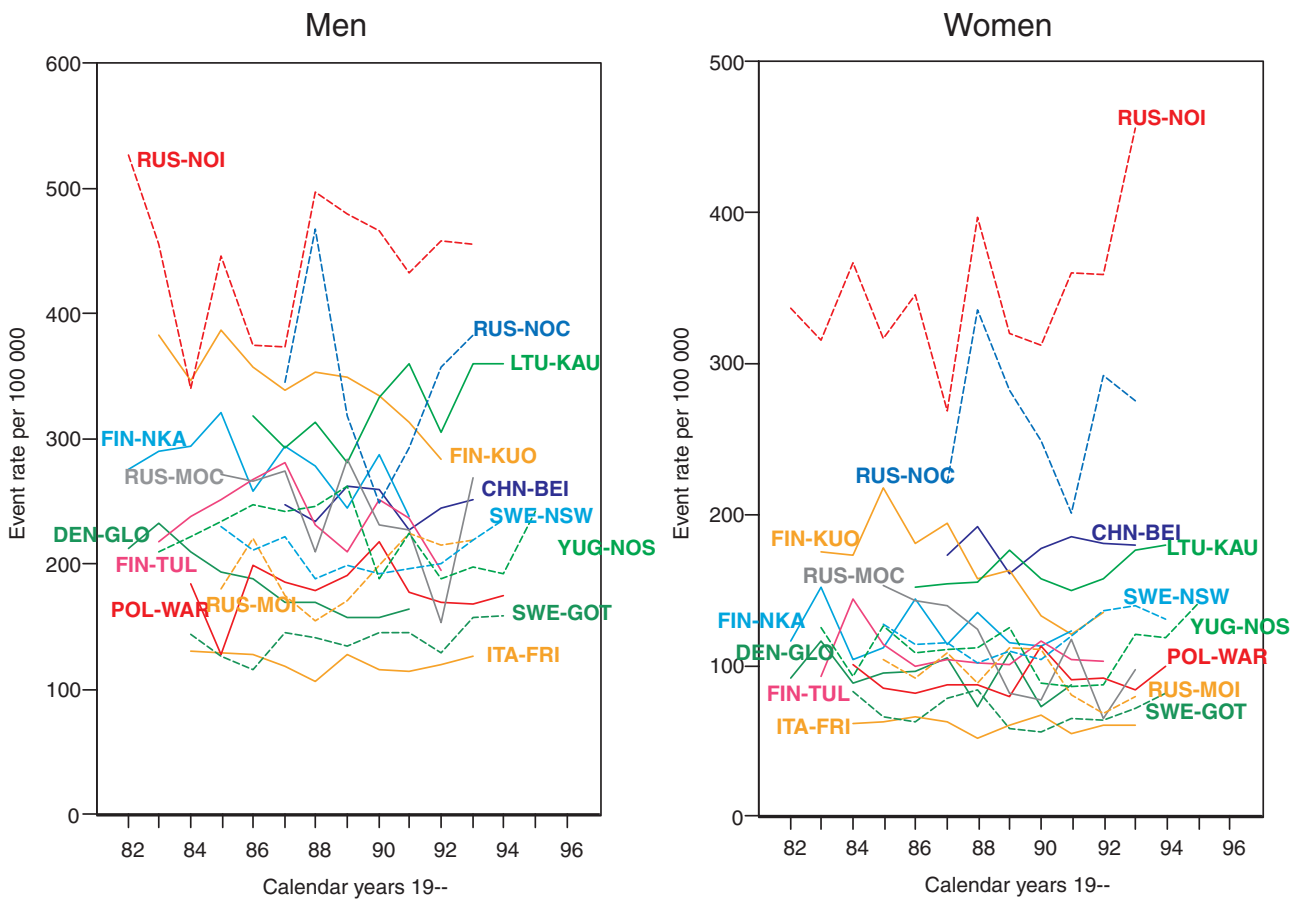
### G26

5. The x-axes of the graphs for stroke-event rates in G26 show the same maximum readings for men and women as their rates are not as different as those previously described for coronary-event rates. Comparison with the values in G12 and G13 shows that these stroke rates are intermediate between the coronary-event rates in men and women.

## G26 Overall stroke rates: first three years and final three years of registration



## G27 Overall stroke rates by calendar year of registration



## G28

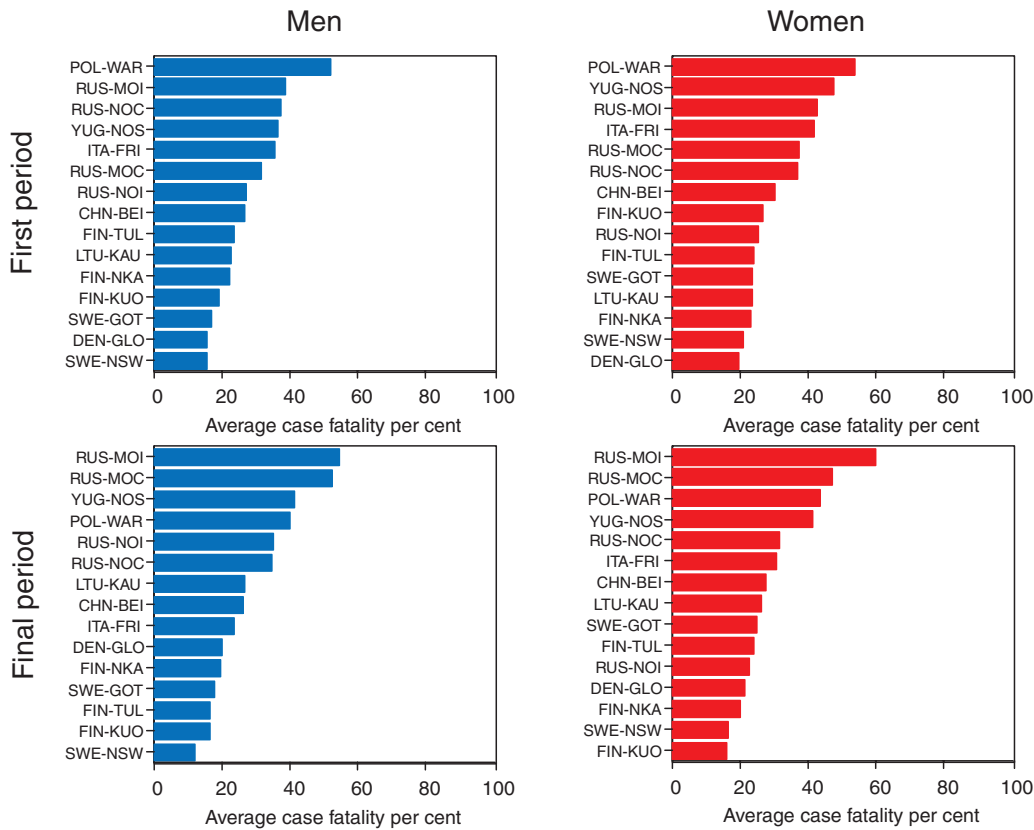
1. *The calendar years involved in each three-year period differed by population, and are identified in G9. They are not necessarily the same as those used in registration of coronary events.*
2. Case fatality is the proportion of events ending fatally within 28 days from onset. See #37 *Event Rates, Case Fatality and Trends*, MONICA Manual Part IV, Section 2 (1), MONICA Data Book of stroke events, table 8.1 (1), MONICA Publication 19 (2).
3. The denominator is all events and the scale is therefore the same for men and women. Case fatality does not involve population demographic data.
4. *Results are age-standardized for the 34–64 age group, using the weightings for case fatality in MONICA. See #39 Age Standardization.*
5. *The case fatality shown is for strokes defined using MONICA diagnostic criteria. See #26 and #27 Registration of Stroke Events, Diagnosis of Stroke, MONICA Publication 5 (2).*
6. Case fatality shown here may be higher than that derived from hospitalized stroke cases. Results include all stroke deaths. Some of these (particularly cerebral haemorrhage) may occur rapidly before admission to hospital, although this is less common than it is for coronary deaths. Clinical case series may start with admission to hospital, and follow-up may cease at hospital discharge, rather than the 28 days used here.
7. The complement of case fatality, survival, should relate to acute management of stroke. Differences in case fatality probably also reflect variations between populations in the distribution of stroke subtypes (haemorrhagic versus ischaemic strokes) and variations in stroke severity at onset. Case-mix also reflects the relative success of the MONICA registers in finding both fatal strokes and non-fatal stroke cases of all degrees of severity. This problem of case ascertainment of fatal versus non-fatal cases is probably greater in the delineation of specific stroke subtypes. (See G35, subarachnoid haemorrhage.)
8. Confidence intervals, an index of precision, are not given. Rates are averaged over three years. See MONICA Data Book of stroke events tables 5.1, 8.1 (1) for numbers. As in coronary events, the case fatality appears higher in women than in men. Within each sex there is a nearly four-fold variation across population RUAs in case fatality without any apparent modal values. (Compare with G16 and G17.) G28 illustrates the variation between populations, and between the two sexes, changes in case fatality over time and the resulting change in population rankings. There is some apparent geographical clustering of results.

## G29

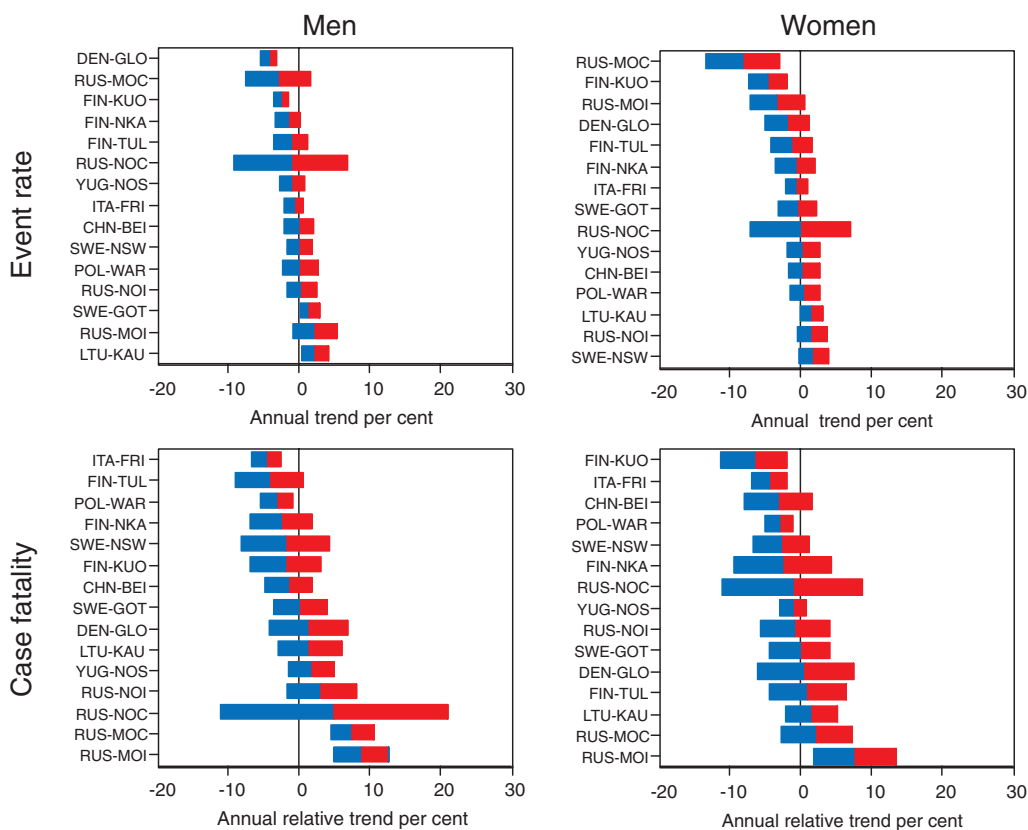
9. Horizontal bars in G29 show the 95% confidence intervals around estimated annual trends. The smaller the length of the bars, the more precise the estimated trend. If the bars fail to cross the zero line, the estimated trends are considered to deviate significantly from zero. Declining trends are shown to the left of the zero line, and increasing trends to the right.
10. Confidence intervals are similar for men and women because the number of events is similar. Examination of the year-on-year trend for Russia-Novosibirsk Control, RUS-NOC, see #75, in G27 helps to explain lack of precision in the estimated trend in G29.
11. G29 shows that incidence rates of stroke events are tending to decrease in around half the populations but some of the remainder show an increasing trend. The trends in case fatality show a fairly similar pattern. With a few exceptions estimated trends in individual populations are not large enough to be statistically significant, as they are small in relation to the width of the confidence interval. See MONICA Publications 19, 25, 45 (2), MONICA Data Book of stroke events table 5.1 (1). MONICA Publications on stroke, incorporating these results, were in preparation at the same time as this Monograph. (Note that some of the RUAs used in these differ slightly from those in this Monograph, so the results may disagree on particular populations—see note 6 on G1, G2.)

1. See **Monograph CD-ROM or MONICA Website** <http://www.ktl.fi/monica/>.
2. **Full references and summaries of MONICA Publications appear in #85/86.**

## G28 Stroke case fatality: first three and final three years of registration



## G29 Average annual change in stroke-event rates and in case fatality



*Notes in italics are repeated to help random browsers—systematic readers should ignore them*

### G30

1. *The calendar years involved in each three-year period differed by population, and are identified in G9. Mortality rates are those for definite and unclassifiable strokes, excluding cases classified as not stroke. See #26 and #27 Registration of Stroke Events, Diagnosis of Stroke, #37 Event Rates, Case Fatality and Trends, MONICA Manual Part IV, Section 2 (1), MONICA Quality assessment of stroke registration data (1), MONICA Data Book of stroke events, table 7.1 (1).*
2. *Results are age-standardized for the 35–64 age group, using the world standard population. See #39 Age Standardization.*
3. *Mortality rates in G30 show a four-to-one variation in both men and women, and higher mortality rates in men within each population RUA. There is a geographical gradient in stroke mortality from western and northern Europe towards the east.*
4. *MONICA stroke data involve fewer RUAs and fewer events, taking both sexes together, than do coronary events, along with different diagnostic and case-finding challenges. In contrast with the findings for coronary events discrepancies between the official and MONICA-validated stroke mortality rates occurred in only a small number of RUAs so we have not included stroke graphs equivalent to G19 and G20. The material for constructing such graphs is found in MONICA Quality assessment of stroke registration data, tables 7 and 8 (1).*

### G31

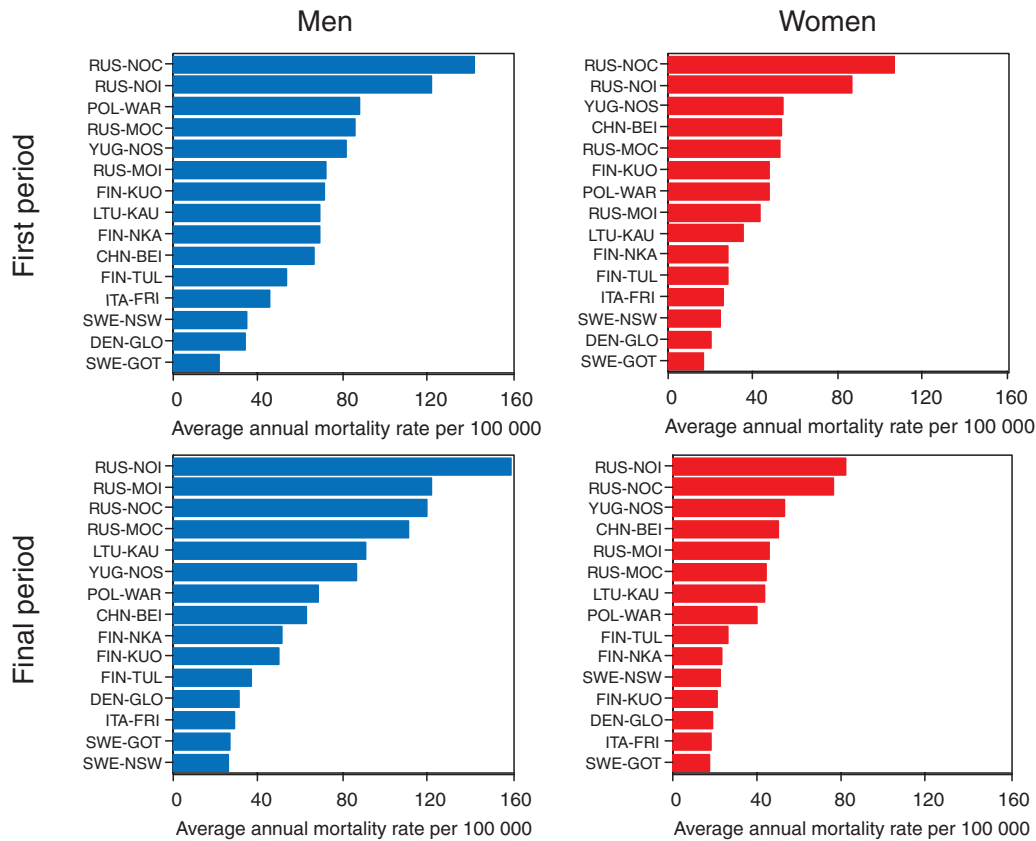
5. *Calculation of trends is explained in #37 Event Rates, Case Fatality and Trends. Horizontal bars in the mortality rate plots of G31 show the 95% confidence intervals around the estimated annual trend. The smaller the length of the bars, the more precise the estimated trend. If the bars fail to cross the zero line, the estimated trend is considered to deviate significantly from zero. Declining trends are shown to the left of the zero line and increasing trends to the right.*

6. *The upper graph in G31 shows the change in stroke mortality rates. The tendency is towards a decline in the majority of populations in both sexes, but there is a cluster of populations in eastern Europe with increasing mortality.*
7. *It can be shown mathematically that changes in stroke mortality rates are the sum of changes in stroke-event rates and relative changes in case fatality. The lower graphs in G31 plot the ranking of change in stroke mortality (already shown in G31 with confidence intervals), but this time as the sum of the two contributing components. G31 suggests that change in case fatality is the major contributor to changing mortality rates from stroke, particularly when they are increasing, with a lesser contribution from decline in stroke-event rates.*
8. *These results contrast with those for coronary events (G22 and G23), which originated with the analyses for MONICA Publication 36 (2). Equivalent MONICA Publications for stroke were in preparation at the same time as this Monograph (1). (Note that some of the RUAs used in these differ slightly from those in this Monograph, so the results may disagree on particular populations. See note 6 on G1, G2.) It was the decline in event rates that accounted for two-thirds of the decline in mortality from coronary heart disease. See G23. The confidence intervals in G29 and G31 are wide in relation to the estimated trends, particularly those for case fatality. Calculation of the relative contribution of trends in event rates, and in case fatality, to declining stroke mortality rates may be more subject to random error or 'noise' than is the case for coronary events.*

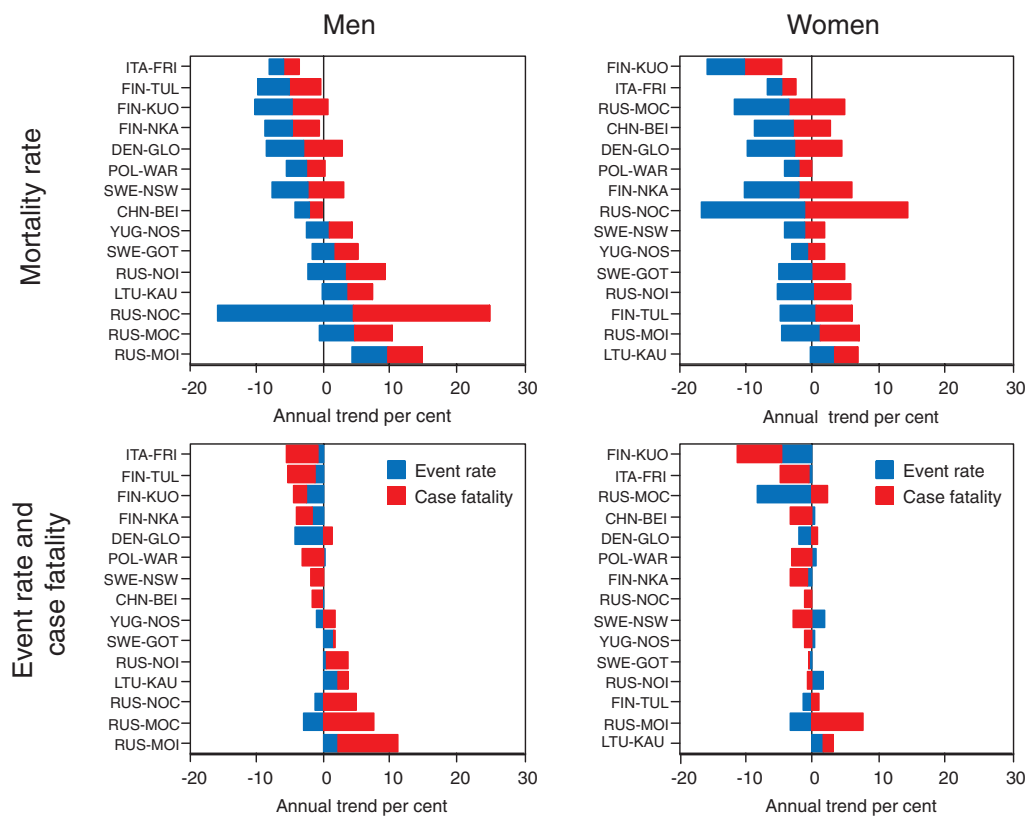
1. [See Monograph CD-ROM or MONICA Website http://www.ktl.fi/monica/.](http://www.ktl.fi/monica/)
2. [Full references and summaries of MONICA Publications appear in #85/86.](#)



### G30 Stroke mortality rates: first three years and final three years of registration



### G31 Changes in stroke mortality rates divided between changes in stroke-event rates and changes in case fatality

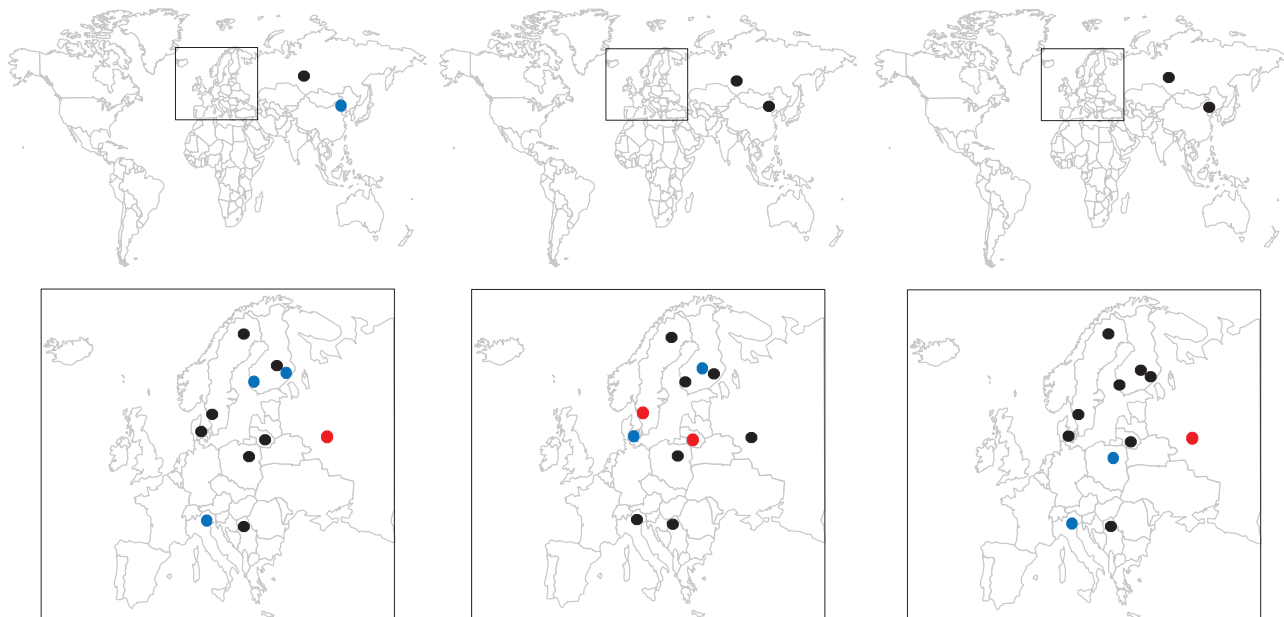


1. The six spot maps, in G32 and G33 are derived directly from the data already shown on trends in stroke-event rates and on trends in case fatality in G29, and on trends in mortality rates in G31. However, the two Moscow population RUAs, and two Novosibirsk RUAs, are combined to produce one RUA for each city in these maps.
2. Blue spots indicate populations whose estimated trend for that end-point and its confidence intervals are to the left of the zero line in G29 or G31 indicating a significant decline.
3. Red spots indicate populations whose estimated trend for that end-point and its confidence intervals are to the right of the zero line in G29 or G31 indicating a significant increase.
4. Black spots indicate populations where confidence intervals straddle the zero line, so the estimated trend does not deviate significantly from zero, even though the trend estimate may be to one side of it, as is usually the case.
5. Fifty-six of the seventy-eight spots in G32 and G33 are black, so most individual estimates of trends failed to deviate significantly from zero. In most populations the number of stroke events being recorded each year in the below 65-year age group was modest in relation to the trends that were being investigated. Stroke numbers were smaller than those for coronary events in men, for which the original MONICA power calculations had been done. Some MONICA centres extended their age-range for stroke to 74, instead of 64, increasing the number of registrations and making analysis of trends more precise. This happened in 8 of the 15 RUAs. Results are not shown here. See MONICA Quality assessment for stroke event registration data (1) and MONICA Data Book of stroke events (1).
6. Perhaps because there were fewer stroke populations than there were for coronary events and less precision in estimating trends, geographical clustering of the coloured spots seems less obvious. Contrast G32, G33 with G24, G25. There is more of a geographical pattern to be seen in G29 and G31 if tendencies to increasing and decreasing trends are considered. For consistency with other spot maps in this Monograph, G32 and G33 feature only results that reach statistical significance.

1. See **Monograph CD-ROM** or **MONICA Website** <http://www.ktl.fi/monica/>.

2. **Full references and summaries of MONICA Publications appear in #85/86.**

### G32 Spot maps of changes in stroke end-points in men



Change in MONICA stroke mortality rate

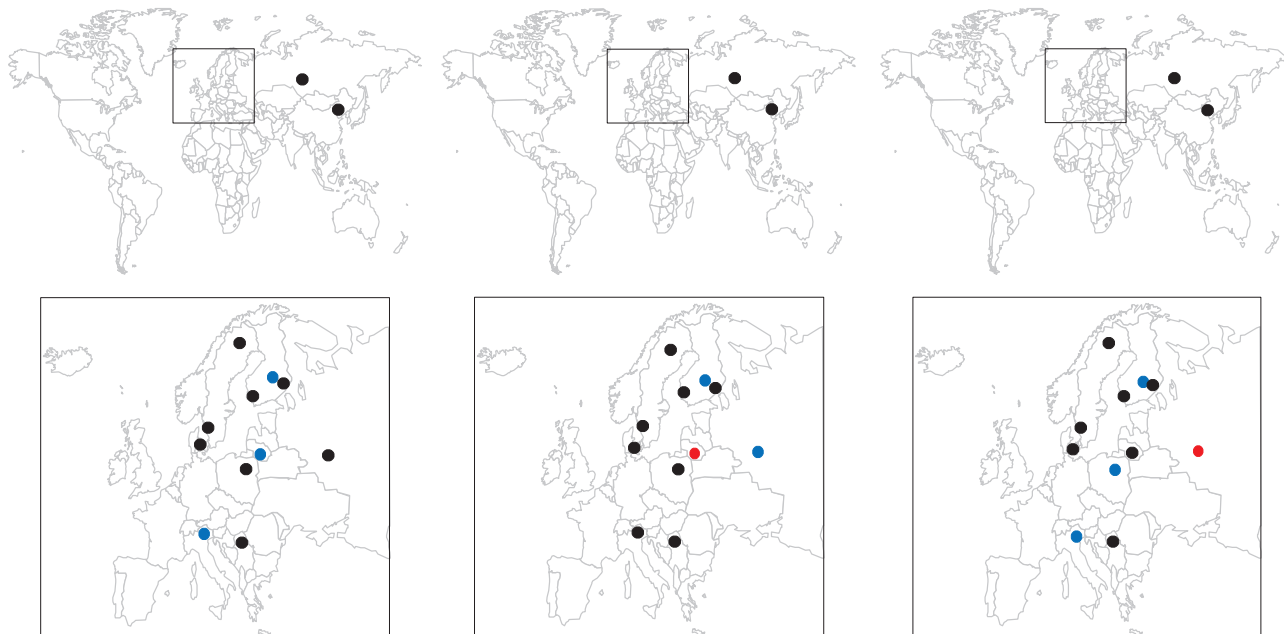
Change in stroke event rate

Change in stroke case fatality

Significant increase  
 Insignificant change  
 Significant decrease

Men

### G33 Spot maps of changes in stroke end-points in women



Change in MONICA stroke mortality rate

Change in stroke event rate

Change in stroke case fatality

Significant increase  
 Insignificant change  
 Significant decrease

Women

### G34

1. A recurrent concern in MONICA analyses is whether extreme results, or indeed the general pattern of results, could be influenced by variations in the quality of data. Quality assessment was rigorous. The results are explicit, are published, and are taken into consideration in the major analyses. See MONICA Quality assessment of stroke event registration data (1), MONICA Quality assessment of demographic data (1).
2. In G34 the relation between the stroke end-points, and the quality score allocated to each population for its stroke data, may not be random. Patterns are not consistent across the sexes. Any weak relation that there is can be shown in formal calculations not to be strong enough to suggest that study results are being seriously compromised or confounded by the quality of items that have been measured.
3. The document explaining the derivation of the stroke-event quality score is published on the MONICA Website as Stroke Event Trend Quality Score for the WHO MONICA Project (1).

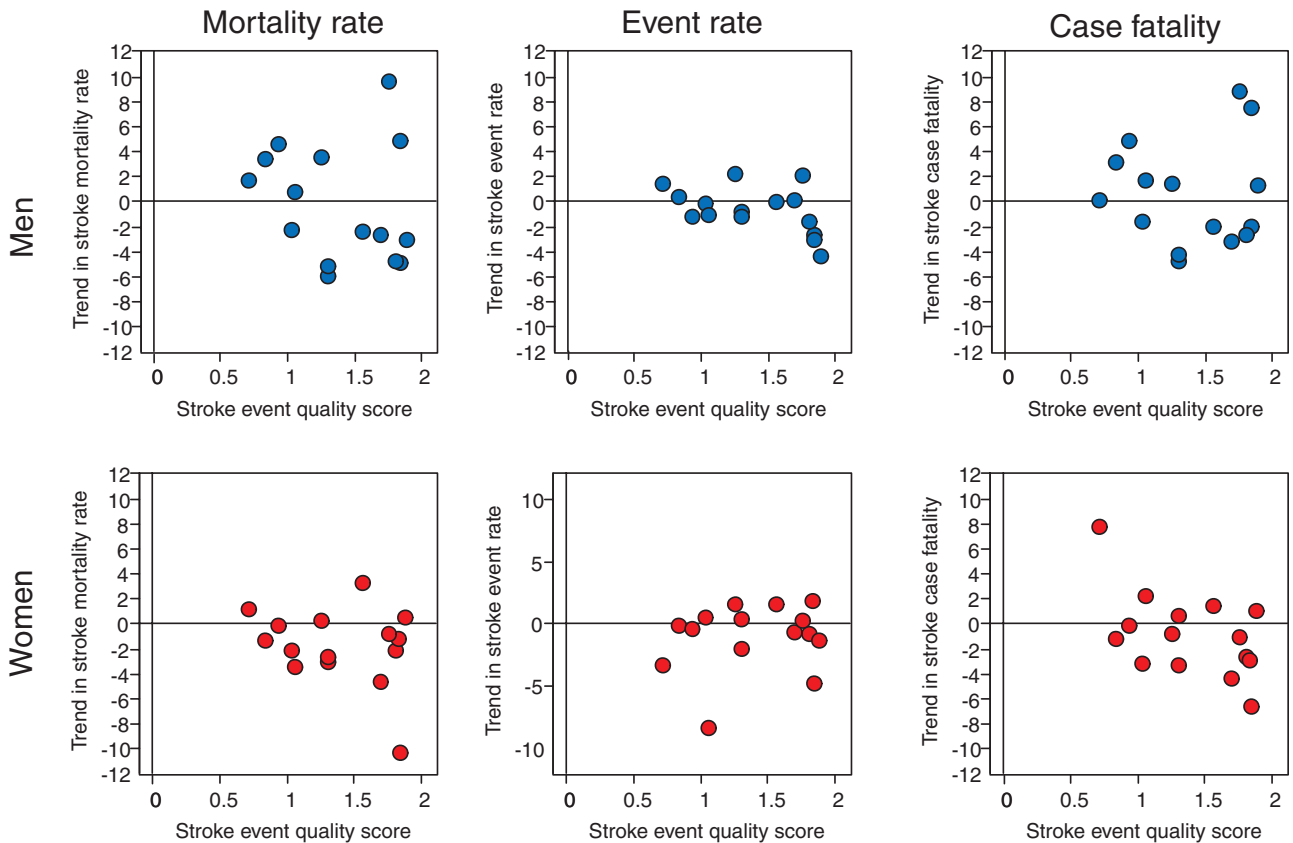
### G35

4. Subarachnoid haemorrhage is a specific variety of stroke in which there is bleeding into the cerebro-spinal fluid from a congenital weakness in a middle-sized artery at the base of the brain. Confirmation depends upon specific diagnostic tests. Subarachnoid haemorrhage has a younger age-distribution than other subtypes of stroke. It is very commonly considered for neurosurgical treatment to prevent recurrence. See #26 and #27 *Registration of Stroke Events, Diagnosis of Stroke*, MONICA Manual Part IV, Section 2 (1), MONICA Data Book of stroke events tables 4.3, 4.4 (1), MONICA Publication 40 (2).

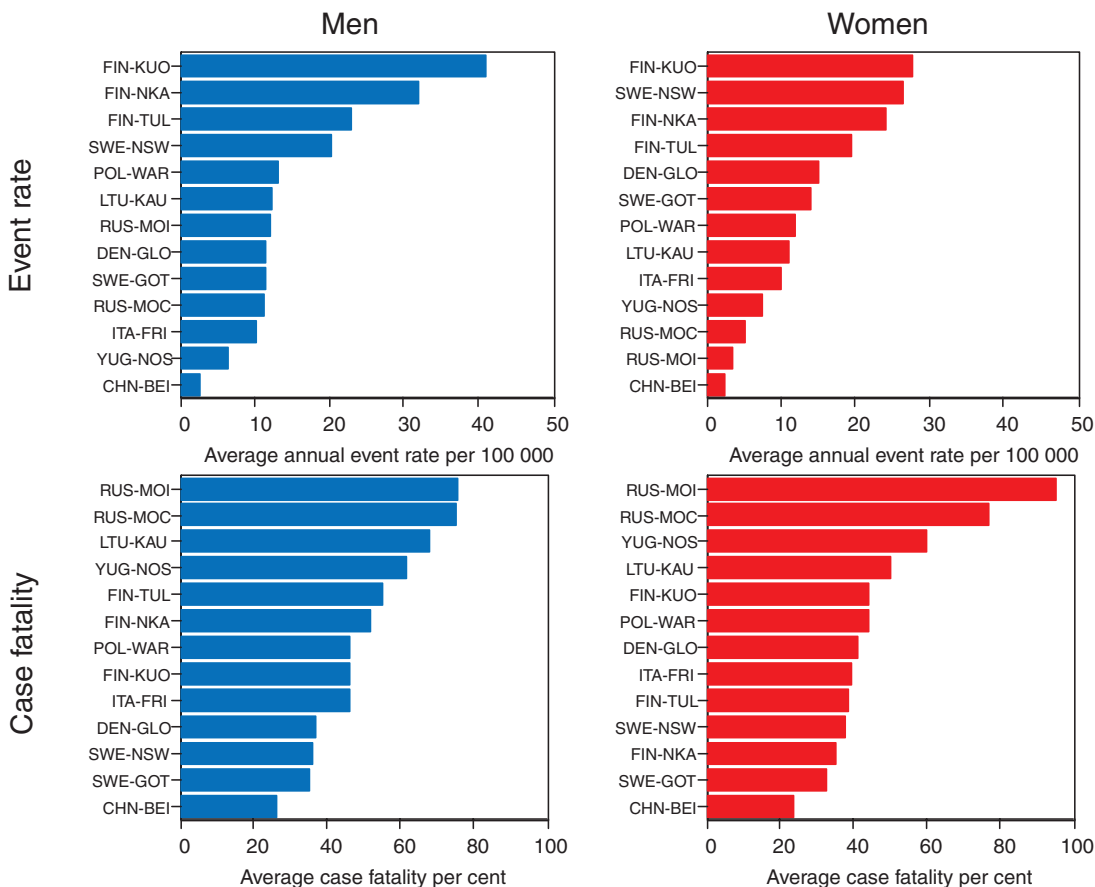
5. Numbers of cases are small compared with stroke overall. Unlike other graphs in this Monograph, results in G35 are averaged over the whole registration period for the population concerned. Despite this, the estimated rates are small (approximately 10% of overall stroke rates) and cannot be very precise.
6. With the need for greater investigational and diagnostic involvement, some stroke registers had greater problems than others in satisfying MONICA criteria for reliably identifying fatal and non-fatal stroke subtypes such as subarachnoid haemorrhage. Problems of data quality have led to results from fewer population RUAs featuring in G35 than for the other overall stroke results.
7. Since autopsy is not performed in China, the low case fatality there may be from failure to identify all fatal cases of subarachnoid haemorrhage. Through relatively small numbers, some of the other results will have limited precision. Despite these limitations, this is a unique set of data on international variation in frequency and outcome of subarachnoid haemorrhage. See MONICA Publication 40 (2) whose subject is subarachnoid haemorrhage in MONICA. In that paper the choice of population RUAs is slightly different from that in G35. Some RUAs shown in the latter have been amalgamated but the paper included data from the limited period of stroke registration in Germany-East Germany, GER-EGE, see #65.

1. See **Monograph CD-ROM or MONICA Website** <http://www.ktl.fi/monica/>.
2. **Full references and summaries of MONICA Publications appear in #85/86.**

### G34 Change in stroke end-points, by population, against stroke-event quality scores



### G35 Event rates and case fatality: subarachnoid haemorrhage

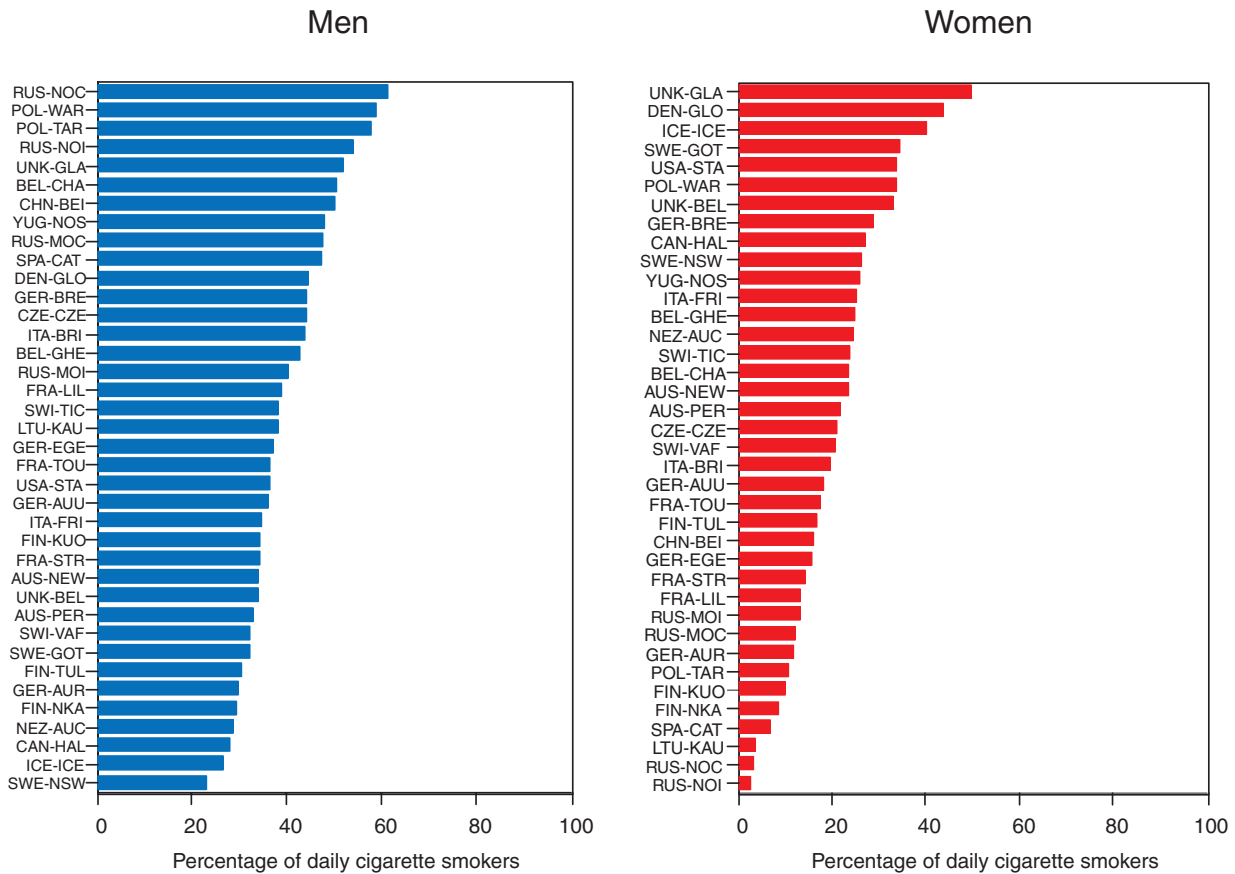


## Risk factors: daily cigarette smoking

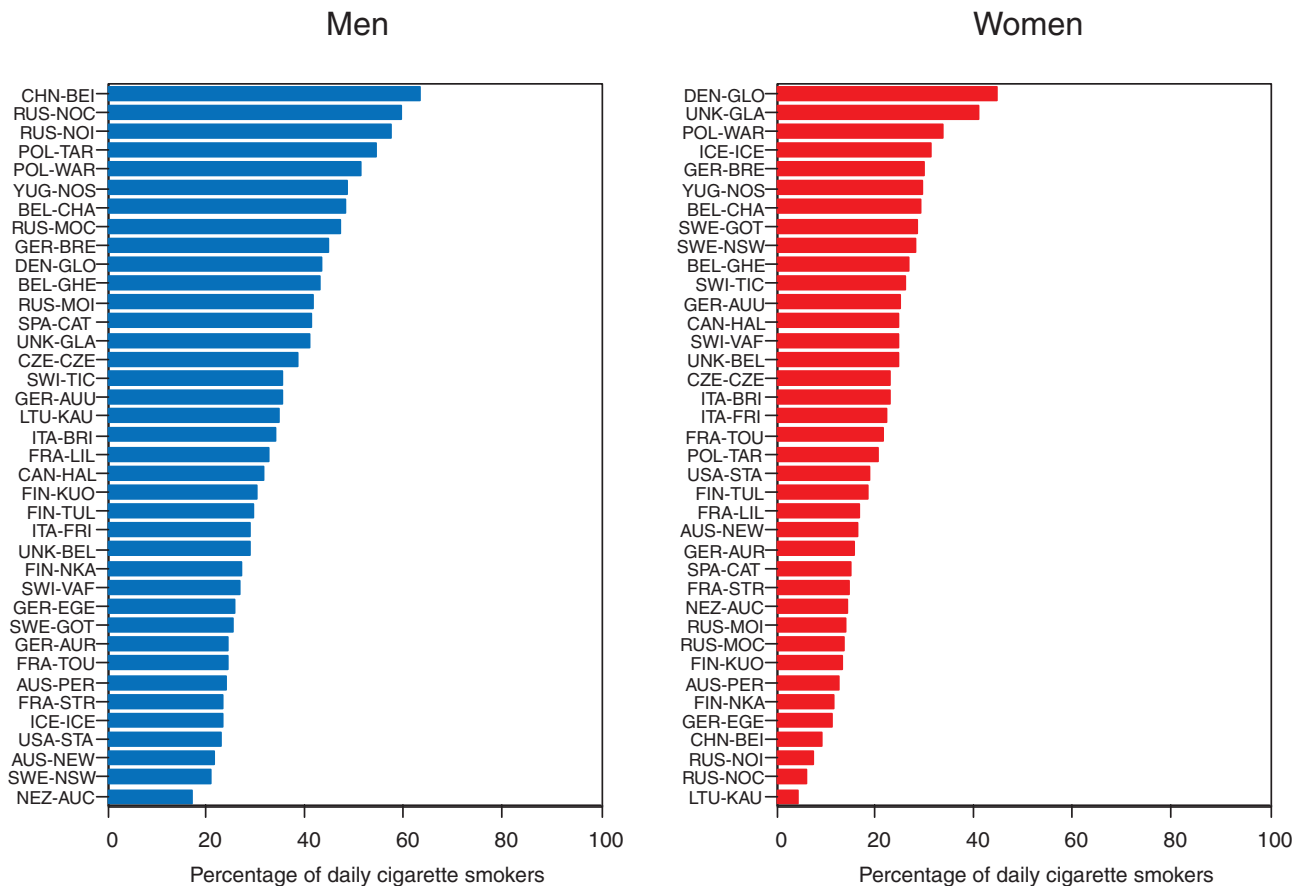
1. The timing of the initial and final surveys differed by population. These surveys were usually eight to ten years apart but the interval could be as little as six years. The calendar years and months varied. See G10 and MONICA Quality assessment of age, date of examination and survey periods (1).
2. Results are shown as the estimated prevalence, or percentage, of daily cigarette smokers in the 34–65 age group. The results are age-standardized to minimize any effect of differing age structures on the apparent findings. See #38 *Population Prevalence and Trends*, #39 *Age Standardization*, #31 *Smoking*.
3. The graphs characterize men and women over a thirty-year age band in each survey for each population with a single value, but levels and trends vary with age. Age-specific data are available in the MONICA Data Book of population surveys, table 6.4.3 (1), and early results in MONICA Publication 11 (2).
4. Survey results could be influenced by failure to participate by some of those selected for the survey. The issue is complex, as different methods of recruitment and sampling were used in different populations. There is more than one definition of response rates. See #28 *Sampling*, #29 *Recruitment and Response Rates*, MONICA Quality assessment of participation rates, sampling frames and fractions (1).
5. A daily cigarette smoker was someone who usually smoked at least one cigarette a day. Comparisons of smoking prevalence between populations are not as simple as they may appear. In addition to the hard core of daily cigarette smokers, easy to categorize, there are variable numbers of additional smokers who are less easy to classify, such as weekend or social smokers, pipe and cigar smokers. These groups create problems in standardizing the assessment of the prevalence of smoking. See #31 *Smoking*, MONICA Quality assessment of data on smoking (1), MONICA Manual Part III, Section 1 (1).
6. Smoking is the only classical risk factor ascertained by questionnaire. Because of the potential for concealment of smoking by ‘deceivers’ biochemical validation was attempted in MONICA using serum thiocyanate. See MONICA Manual Part III, Section 3 (1). This was found to be neither sensitive nor specific, and it was abandoned. Some centres measured expired-air-carbon-monoxide and/or serum cotinine on all or some of their participants. However it is questionnaire results that are used in these analyses. See MONICA Quality assessment of data on smoking (1).
7. The scales for men and women are the same. Smoking prevalence was generally higher in men than in women in the same population, with a few exceptions such as United Kingdom-Glasgow, UNK-GLA, see #81, where findings in the two sexes were similar. Some populations showed a large disparity in their ranking for men and women. This is true of the two Russia-Novosibirsk populations in the initial survey, RUS-NOC, RUS-NOI, see #75, and China-Beijing, CHN-BEI, see #55, in the final survey.
8. Data for these graphs are found in the MONICA Data Book of population surveys, table 6.4.3 (1). The Data book and the MONICA Quality assessment of data on smoking (1) contain tables describing items of smoking behaviour not shown here, such as the prevalence of never smokers and former or ex-smokers, numbers of cigarettes smoked, and frequency of other varieties of tobacco smoking. See the MONICA Data Book of population surveys, tables 6.4.2–6.4.6 (1).

1. See **Monograph CD-ROM or MONICA Website** <http://www.ktl.fi/monica/>.
2. **Full references and summaries of MONICA Publications appear in #85/86.**

### G36 Prevalence of daily cigarette smokers in the initial risk-factor survey



### G37 Prevalence of daily cigarette smokers in the final risk-factor survey



### G38

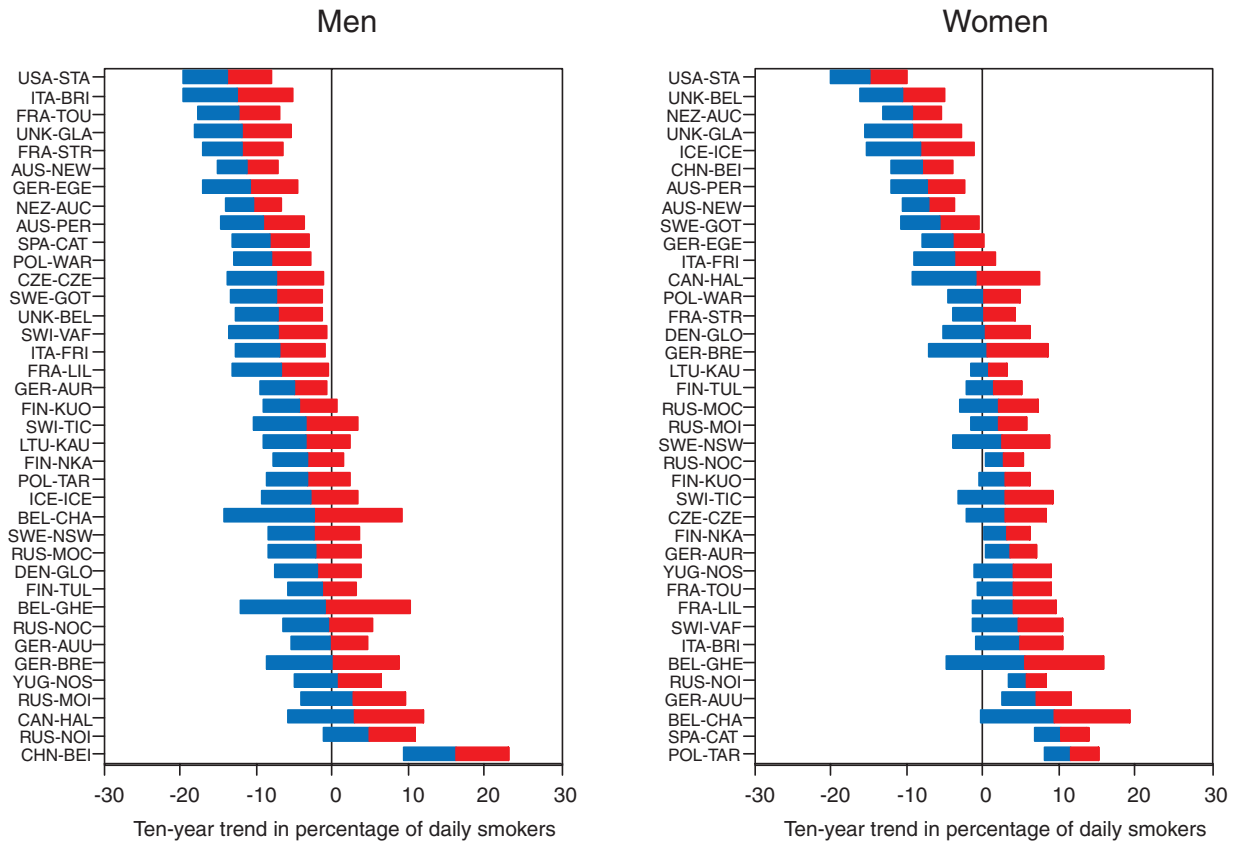
1. Calculation of trends is explained in #38 *Population Prevalence and Trends*.
2. The initial and final surveys did not take place exactly ten years apart. G38 incorporates corrections to standardize the differences, as if they were being measured across ten years.
3. Horizontal bars in G38 show the 95% confidence intervals around the estimated 10-year trend. The smaller the length of the bars the more precise the estimated trend. If the bars fail to cross the zero line the estimated trend is considered to deviate significantly from zero. Declining trends are shown to the left of the zero line, and increasing trends to the right.
4. Confidence intervals are similar for men and women; the population surveys sampled them in similar numbers.
5. G38 shows different trends in smoking between men and women in the different populations. The majority of male populations show a decrease in smoking, so that the tendency is to the left of zero in 32 populations and towards an increase, right of the zero line in five. In women, it is a minority of populations that show a decrease in smoking. Twelve are to the left of zero and 25 are to the right. Results varied in different age groups. What is shown here is an age-standardized summary statistic. Age-specific data are available in the MONICA Data Book of population surveys, table 6.4.4 (1).

### G39

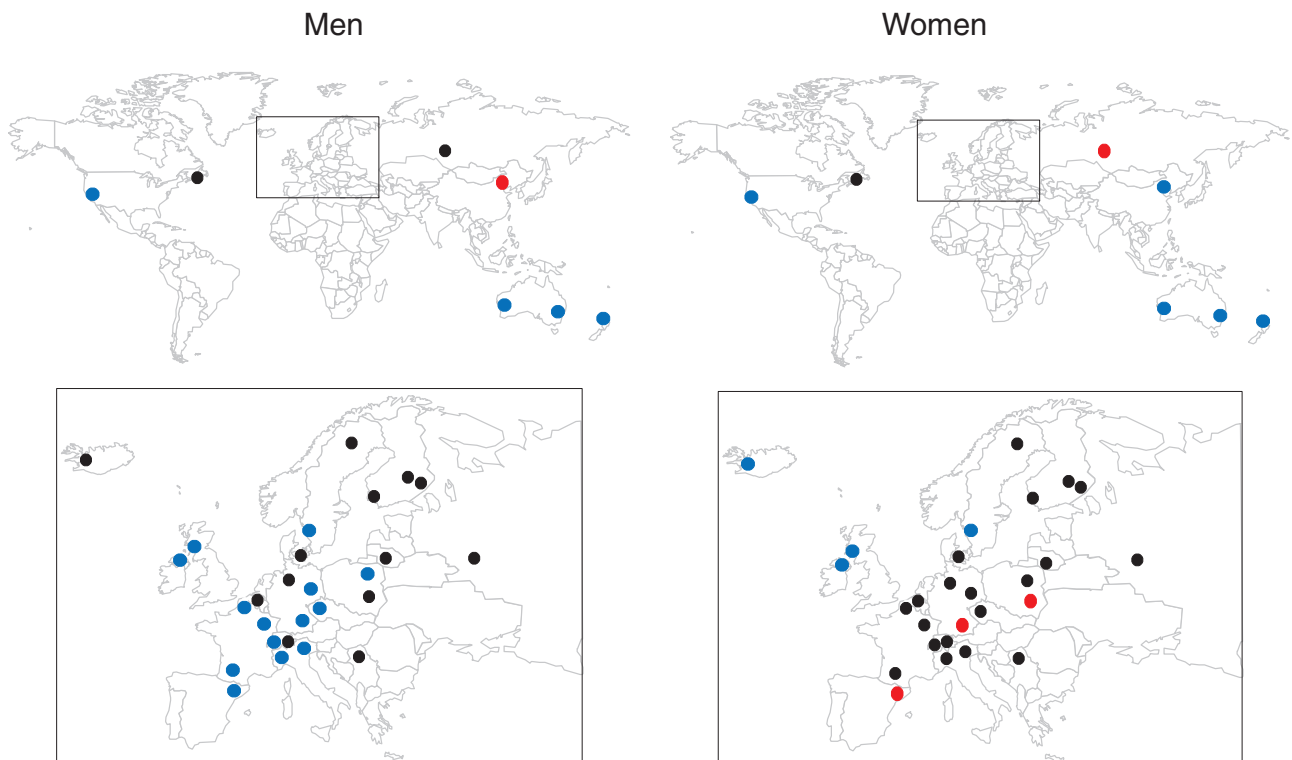
6. G39 is a spot map showing the geographical distribution of the results shown in G38. Half or more of the confidence intervals in G38 include zero. The populations concerned are marked by black spots. Those with a significant decrease in smoking levels are shown with blue spots, while a significant increase is shown with a red spot.
  7. G39 shows little difference between the sexes outside Europe. Within Europe however, there are no male populations showing a significant increase in smoking and many show a significant decrease. In women increases and decreases are almost evenly balanced.
  8. It is unlikely that smoking data of poor quality had a significant effect on overall MONICA results. G56 (see later) shows acceptable quality scores for most populations and little correlation in the scatter plot between quality scores of the smoking data and the apparent trends in smoking. See MONICA Quality assessment of data on smoking (1).
  9. Trends in cigarette smoking in the MONICA populations are the subject of MONICA Publications 34 and 42 (2); early cross-sectional data are found in MONICA Publication 11 (2).
1. See **Monograph CD-ROM** or **MONICA Website** <http://www.ktl.fi/monica/>.
  2. **Full references and summaries of MONICA Publications appear in #85/86.**



### G38 Ten-year change in prevalence of daily cigarettes smokers



### G39 Spot maps of population changes in prevalence of daily cigarette smoking



Significant increase  
 Insignificant change  
 Significant decrease