MONICA
Monograph and Multimedia Sourcebook

World’s largest study of heart disease, stroke, risk factors, and population trends 1979–2002

Edited by Hugh Tunstall-Pedoe

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with 64 other contributors

for

The WHO MONICA Project

WORLD HEALTH ORGANIZATION
GENEVA
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Acknowledgements

The MONICA Centres were funded predominantly by regional and national governments, research councils, and research charities. The World Health Organization (WHO) was responsible for coordination. It was assisted in the organization of congresses and workshops by local staff and fund raising efforts. WHO also supported the MONICA Data Centre (MDC) in Helsinki. In addition, generous long-term support for the MDC was provided by the National Public Health Institute of Finland (KTL), as well as through repeated contributions made to WHO by the National Heart, Lung, and Blood Institute, National Institutes of Health, Bethesda, Maryland, USA. These supported the MDC and the Quality Control Centre for Event Registration in Dundee. The completion of the MONICA Project was made possible by a generous Concerted Action Grant from the European Commission under its BIOMED programme: BMH4-96-1693: MONICA: Multinational MONItoring of trends and determinants in CArdiovascular disease. Subsequently, archiving of MONICA data and substantial funding for the production of this Monograph were provided by a Shared Cost Grant from the BIOMED 2 Third Call from the European Commission, Contract BMH4-CT98-3183: the MORGAM Project: MONica Risk, Genetics, Archiving and Monograph. Recurrent grants to support data analysis and the preparation of publications were also gratefully received from ASTRA Hässle AB, Sweden, Hoechst AG, Germany, Hoffmann-La Roche Ltd, Switzerland, the Institut de Recherches Internationales Servier (IRIS), France, and Merck & Co. Inc., Whitehouse Station, NJ, USA. Preparation of this Monograph was supported by all these grants. Final production costs were financed by the BIOMED 2 grant from the European Commission, by the World Health Organization, and by specific grants from the British Heart Foundation (funding production costs of the Monograph CD-ROMs) the Swedish Heart and Chest Foundation, AstraZeneca, the Becel Institute from Unilever, Boehringer-Ingelheim, GlaxoSmithKline, Merck and Co. Inc., Whitehouse Station, NJ, USA and Pfizer Inc.

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The MONICA Monograph and Multimedia Sourcebook has been written and produced by the MONICA collaboration without any personal payments. The World Health Organization and the WHO MONICA Project acknowledge the outstanding contribution to this project of Hugh Tunstall-Pedoe of the Cardiovascular Epidemiology Unit, Institute of Cardiovascular Research, University of Dundee, Scotland, in masterminding, leading and managing it from its inception, and as editor, principal author and fund-raiser; also that of Kari Kuulasmaa and Hanna Tolonen and their colleagues in the former MONICA Data Centre, now the International CVD Epidemiology Unit of the National Public Health Institute in Helsinki, Finland.
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Cardiovascular epidemiology is a fairly recent discipline. Until 1975, it concentrated on identifying and substantiating the role played by classic risk factors in determining individual risk, as done, for example in the Framingham study, and also how they related to population disease rates, as, for example in the Seven Countries Study. Standardized methods of measurement were developed both in Minneapolis and elsewhere and formalized with the publication, in 1968 by the World Health Organization, of Cardiovascular Survey Methods, now entering its third edition.

In the mid-1970s there came the realization that mortality from coronary heart disease was falling in the United States. The seminal Conference on the Decline in Coronary Heart Disease Mortality was organized in Bethesda, USA in 1978. Its sponsor, the National Heart Lung and Blood Institute in Washington began to fund studies of cardiovascular disease trends in whole communities, such as the Minnesota Heart Survey—which ran concurrently with the planning and launch of the WHO MONICA Project—and later the ARIC study.

Despite consultation with and input of American expertise in the planning of MONICA, the major monitoring initiatives in the USA that began before or at the same time as MONICA were not completely compatible. This left only one US centre, Stanford, as a full MONICA participant providing data. American investigators, centrally funded and closely linked with one another, envied the great heterogeneity of the populations involved in the WHO MONICA Project. They did not, however, envy the consequent problems for standardization and data quality that MONICA struggled successfully to overcome. MONICA is a landmark study in our understanding of and efforts to control cardiovascular disease.

Having chaired the session of the European Congress of Cardiology in Vienna in 1998 at which many MONICA graphics were first displayed, I am delighted to now see them in print. On behalf of its American friends, I welcome the MONICA Monograph.

Russell Luepker

Division of Epidemiology, School of Public Health
University of Minnesota, Minneapolis USA
Congratulations!

The WHO MONICA Project was set up to explore trends in cardiovascular disease in different populations. These eventually encompassed 38 populations in 21 countries on four continents, but the biggest contributor was Europe. Never intended as a study of national disease trends, the Project nevertheless stimulated friendly international rivalry. When the closing date for entry was fixed for 1985 some of us realized that our own countries could never be represented. We were doomed to spend the next 15 years or so on the outside looking in—a regret shared, for example by Austrian, Dutch, English, Greek, Portuguese, and Republic of Ireland colleagues as well as by myself, a Norwegian.

During the 1980s and 1990s we watched your collaborative struggle to make the MONICA Project a success. Recently we have been stimulated and fascinated by the study results. Now you are sharing all aspects of the study with us in this Monograph and Multimedia Sourcebook. Apart from its scientific contribution, MONICA has ignited vivid interest around the world, disseminating both the concepts and the disciplined practice of cardiovascular epidemiology. The Monograph will further spread this learning and teaching process on the interface of cardiology and public health.

On behalf of all those on the outside involved in the epidemiology and prevention of cardiovascular disease, I would like to send my congratulations and best wishes to the MONICA family on this momentous publication. I encourage both insiders and outsiders to make maximum use of this amazing resource.

Dag Thelle

*Cardiovascular Epidemiology and Prevention*

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With the end of the Second World War, and the consequent foundation of the World Health Organization (WHO) in 1948, improved nutrition, education, immunization, quarantine, insecticides, antibiotics and other biomedical products helped to reduce the rates of many diseases caused by deficiency, bacteria and parasites. In many old and new industrializing countries however, life expectancy failed to improve proportionately, because of a rise in deaths from heart disease. Through the International Classification of Diseases, and the international format for death certificates, WHO helped to standardize recording and international comparison of death rates. Successive World Health Statistics Annuals reported striking differences in cardiovascular death rates between countries, but they also showed alarming increases in cardiovascular mortality in a large proportion of those countries that were able to provide such data.

In the 1960s and 1970s the European Regional Office of WHO convened expert groups to plan collaborative studies of cardiovascular disease and risk factors. It fostered the international standardization of definitions, for example of myocardial infarction, and the measurement of morbidity as in the European Myocardial Infarction Registers, as well as encouraging prevention.

At the end of the 1970s, intense interest in population trends in cardiovascular disease precipitated an initiative from the then Cardiovascular Diseases Unit at WHO Headquarters in Geneva. This encouraged those investigators intending to measure disease and risk-factor trends in their own populations to come together, to standardize their definitions and their measurements, and to combine their findings. This initiative led to the WHO MONICA Project.

MONICA was a huge undertaking—impossible without the pivotal role of WHO, but also the support of other organizations. This support included funding of participating centres by governments and charities, support for the MONICA Data Centre by the National Public Health Institute in Helsinki, Finland (KTL), and important supplementary funding for quality control, coordination and data analysis from the National Institutes of Health in Washington, and later from the European Commission and others, and now for publication of this Monograph.

MONICA combined the old with the new. It emphasized standardized measurement of mortality, morbidity, risk factors and medical care. In addition, it combined these potentially routine activities with the publication of quality control results on the Internet, the testing of hypotheses, and the publication of study results in prestigious scientific journals. These hypotheses could not have been tested within one population alone nor without WHO.

In this Monograph MONICA provides unique data on cardiovascular risk factors, mortality, morbidity and medical care from its numerous populations. It’s release will bring added value to WHO’s endeavour to place ‘risks to health’ on the global health agenda through the 2002 World Health Report. The WHR 2002 provides new estimates of the impact of current risk levels on present and projected mortality and morbidity. It highlights the urgent need to address core risk factors common to major noncommunicable diseases including cardiovascular disease. Further the new global estimates reiterate the need to take action on tobacco use, physical inactivity, overweight and lack of fruit and vegetables, as well as their intermediate manifestations; elevated cholesterol, blood pressure and blood sugar. The challenge is substantive and demands complex multisectoral approaches including upstream policy interventions, cost-effective health promotion and practice of clinical prevention.

Derek Yach
Executive Director, Noncommunicable Diseases and Mental Health Cluster
World Health Organization, Geneva, Switzerland
The World Health Organization MONICA Project is an international study of cardiovascular disease that was initiated 23 years ago. It covers 38 populations in 21 countries and on four continents. The importance to the Project of contributions from Asia, Australasia, and North America should not be overlooked, however, the largest contribution in terms of numbers of populations and countries has come from the continent of Europe; from members of the European Union, its candidate members, and other countries in Europe which are closely linked to it and to each other. It was this predominance of European centres that enabled MONICA participants, when funding was scarce during its later years, to bid successfully to the European Commission for two different grants for funds to facilitate research coordination, data analysis and publications. The second of these grants substantially contributed towards funding preparation, editorial work and production of this Monograph.

Although many in Europe see themselves increasingly as European, Member States nonetheless encompass a great diversity of populations with large disparities in lifestyle and disease rates. These are well demonstrated in the following pages. MONICA and the World Health Organization have pioneered the standardized collection of disease, lifestyle and risk-factor data. This experience is now feeding back into the drafting of European guidelines for standard data sets for disease and risk-factor monitoring.

The publication of this Monograph is a major milestone for the World Health Organization and the MONICA investigators. Those involved should be proud of their achievement. That pride will be shared by the organizations and individuals who—in their different ways—helped bring this enterprise to its completion.

Philippe Busquin

European Commissioner for Research, Brussels, Belgium
Editor’s Introduction

T
his Monograph marks the completion of the WHO MONICA Project. Extending to four continents over 23 years, MONICA is the largest and longest research project ever undertaken on heart disease and stroke. We are now sharing with a world readership the excitement and achievement of all that was put into MONICA—and what we and others have gained from it.

International collaboration is not easy, particularly with modern pressures on individual performance and rapid results. The ‘MONICA family’ has collaborated since 1979. In that time world systems and alliances changed, crises came and went, wars were fought, heads of state appeared and disappeared, but the 21 nationalities and 38 research groups in MONICA moved forward together.

MONICA evolved through different phases:
- development of the original concept and research plan
- standardization of methods, recruitment and training
- quality assurance in parallel with data collection
- publication of cross-sectional data
- maintaining and re-evaluating methods, training and quality assurance
- data processing and data analysis
- publication of quality assessments
- publication of main longitudinal results
- evaluation of the project and dissemination of findings.

This publication, from the final phase, brings everything together in a ‘Monograph and Multimedia Sourcebook’, to be used at the level of sophistication that the reader wants. It contains:
- explanations of what the study is about
- descriptions of the participating populations, the local study teams and their work
- abstracts of MONICA collaborative publications, with full references
- 79 graphics of the key MONICA results, with explanatory notes
- finally two CD-ROMs containing:
  a. The MONICA Manual
  b. MONICA Quality assessment reports
  c. methodological appendices to published papers
  d. MONICA Data Books incorporating tables of most of the variables
  e. a 20% sub-set of the MONICA Database for exploration
  f. slide shows covering each of the main MONICA topics
  g. copies of MONICA Memos.

This book can also be used as a textbook on epidemiology for students of medicine, nursing, social sciences and public health. Through its Data Books, it is a source of material for student exercises. The 20% sample Database is a challenge for those interested in data analysis.

The Monograph has been designed for a readership ranging from the general public to journalists and politicians, to medical administrators, medical students, the medical and para-medical professions and different medical specialties. The Monograph should be of interest to anyone interested in cardiac
disease and stroke, in public health and epidemiology, and the wider issues of primary and secondary prevention, lifestyle, risk factors and health policy.

Whether you wish to browse through the graphics, assimilating information from them and the notes, or to read the book systematically, we hope you will share our excitement in the size and scope of this exercise. See how, by sharing our objectives and standardizing our methods, we have been able to draw conclusions for the public good from the variety of experiences of our different populations. The Monograph illustrates the value of international collaboration in understanding and controlling chronic diseases and their causes, and in the dissemination of sound scientific methods. The success of the Monograph will be judged by how much it stimulates health workers and administrators in different countries to think like epidemiologists—on a world scale—and to collaborate in tackling other similar challenges to world health.

Hugh Tunstall-Pedoe

Editor, MONICA Monograph and Multimedia Sourcebook
age standardization, age standardized, age adjusted
rates and outcomes vary with age. Comparison of groups with differing age structure can be misleading unless differences are adjusted for. See #39

AMI/MI
acute myocardial infarction. Heart muscle (myocardium) dies when the coronary artery feeding it is blocked. May be fatal but coronary deaths are not all infarct cases. See #23

BMI
body mass index. Indicator of obesity: weight in kilograms divided by square of height in metres. See #34

CARPFISH
nickname of manuscript group working on the MONICA Second (coronary care) Hypothesis and materials it produced. 'Coronary Artery Revascularization Procedures For Improving Survival from Heart attack'. Still found in some MONICA Web directories.

CAD
coronary artery disease. See CHD

case fatality
proportion of cases of the disease that are fatal within a specified time from onset; in MONICA 28 days, unless otherwise stated. Fatality percent = 100 – survival percent. Do not confuse fatality with mortality. See #37

CHD
coronary heart disease, also known as ischaemic heart disease (IHD). Caused by narrowing or obstruction of the coronary arteries by atheromatous (fatty) deposits and thrombosis, and resulting impairment of the blood supply to the myocardium or heart muscle.

cholesterol
also total, blood, serum or plasma cholesterol. Measured concentration of cholesterol in serum or plasma without regard to the accompanying lipoprotein, as millimoles per litre (mmol/l). Milligrams per decilitre is also used. 5 mmol/l = 192 mg/dl. One of three major, classic risk factors. See #33

CI, 95%CI
confidence interval. Wide interval means poor precision. 95% is the probability that the CI includes the value that is being estimated.

cold pursuit
registration of events from hospital discharge records, usually weeks or months after the event, extracting data from written material. Opposite of hot pursuit. See #20

CORMORANT
nickname for first MONICA final-results paper and accompanying material. Derived from ‘CORonary MORtality And Nonfatal Trends’. Found on MONICA Website directories.

coronary death
not all coronary deaths are from myocardial infarction so classification is complex. Can be sudden, but this is not a specific criterion in MONICA. See #23

coronary event
coronary heart attack, such as acute myocardial infarction or coronary death. MONICA excluded chronic angina pectoris and heart failure. See #23

CVD
cardiovascular diseases—diseases of the heart and blood vessels.

EARWIG
nickname of manuscript group and materials for the First (risk factor) MONICA Hypothesis, derived from ‘EventuAl Results Working Group”. Found in MONICA Website directories.

event rate
rates compare disease in populations by standardizing denominator and time period, such as rate per 100 000 per year. Calculation involves time and denominator, not just numbers of events. See #37

HDL-cholesterol
high density lipoprotein cholesterol—a fifth to one third of the total cholesterol found in blood, serum or plasma—can be distinguished by its density and other physical and biological characteristics. It has been found to be a marker for reduced coronary risk in that high levels are protective, so its behaviour is paradoxical compared with total cholesterol. See cholesterol. See #33

hot pursuit
registration of events through hospital admissions. Allows interview of patients when information is incomplete. Daily surveillance of acute services is necessary and expensive. See cold pursuit. See #20

hypotheses, MONICA main hypotheses
MONICA enunciated two main coronary hypotheses: the First on coronary risk factors, the Second on coronary care. See #2. Stroke hypotheses came later, involving fewer centres and fewer events.

ICD, ICD-8, ICD-9, ICD-CM
International Classification of Diseases, published by World Health Organization, and used worldwide to code diseases and causes of death. The 8th edition 1965 was used by some Scandinavian MCCs, 9th edition 1977 by most MCCs, 10th edition not in use during MONICA. Clinical Modification (CM)—complex system used in some MCCs for hospital episodes.

Manual
Originally in hard copy, then on the website, now on CD-ROM.

**MCC**
MONICA Collaborating Centre.

**MDC**
MONICA Data Centre, National Public Health Institute (KTL), Helsinki, Finland. See #7.

**MMC**
MONICA Management Centre at World Health Organization Headquarters in Geneva, Switzerland. See #6.

**mmHg**
millimetres of mercury, traditional unit for measuring blood pressure. The official international unit, although not in general use, is kilopascals. In conversion 100 mmHg is equal to 13.3 kPa.

**mmol/l**
millimoles per litre (mmol/l), standard (SI) units, replaced milligrams per decilitre (mg/dl) for reporting laboratory results in many countries. For cholesterol (not for other analytes) 10 mmol/l = 387 mg/dl.

**MONICA**
MONICA Project: ‘MONItoring of trends and determinants in CArdiovascular disease’. WHO MONICA Project is international, MONICA a local label.

**Monograph CD-ROM(s)**
Compact Disk(s) accompanying this Monograph contains the MONICA Manual, Quality Assessment reports, Data Books, unpublished appendices to manuscripts, a 20% random sample of most of the MONICA Database, slide shows and other items.

**MRC**
MONICA Reference Centre, coordinating MONICA Optional Study in a specific area. See #9

**MQC**
MONICA Quality Control Centre. See #8

**MSC**
MONICA Steering Committee. See #5

**mortality or mortality rate**
see event rate. Applies to a defined population, or a sex and age group within it, and is usually disease specific. Differs in meaning from fatality or fatality rate. See #37

**official mortality, routine mortality**
MONICA centres obtained routine death certificate data from the statistical offices serving their populations. Official mortality rates in MONICA were statistics based on this routine certification. See #16

**prevention**
in epidemiological terms, anything which reduces disease rates in the population. In cardiovascular epidemiology and cardiology, primary prevention means interfering with the disease process before it causes illness or symptoms while secondary prevention is delaying or preventing progress of the disease once it is apparent. Other classifications are used elsewhere in public health.

**primary prevention**
see prevention.

**quality assessment, quality assurance, quality control**
all involved in attempting to produce a standardized set of data for analysis—where any deficiencies are known and quantified. See #12

**Rapporteur**
World Health Organization title of person responsible for drafting reports on meetings.

**registration, register**
procedures involved in identifying disease events, obtaining relevant clinical information, coding, classifying and listing them. (A register is primarily a list.) See #20

**risk factor**
personal characteristic associated with increased risk of a disease. Classic risk factors, smoking, blood pressure and cholesterol are considered causal for cardiovascular disease; obesity measured as body mass index (BMI) is more controversial.

**RU**
Reporting Units are geographical sub-units of population which can be detected in all data records in MONICA. Some populations had a number of different suburbs or towns as Reporting Units, others had one RU for a whole city.

**RUA**
combinations (Aggregates) of Reporting Units used in MONICA analyses.

**secondary prevention**
see prevention.

**SBP**
Systolic blood pressure, the upper of the two readings taken routinely in blood pressure measurement. A classic coronary risk factor, as is diastolic blood pressure, which features in the survey Data Book, but not in this Monograph.

**SI**
Système International. International convention for standardizing units of measurement.

**stroke**
cerebrovascular disease, the acute illness precipitated by local derangement of the blood supply to the brain, either by obstruction to the artery concerned (ischaemic stroke) or rupture and bleeding into the brain (haemorrhagic stroke), or into the membrane around it (sub-arachnoid haemorrhage).

**sudden death**
see coronary death.

**total cholesterol**
see cholesterol.

**WHO**
World Health Organization.

**WWW**