

Twenty years of MONICA project in Novi Sad - influence of sociopolitical and economic circumstances on stroke epidemiology

20. Godina projekta MONIKA u Novom Sadu - uticaj društveno-političkih i ekonomskih okolnosti na epidemiologiju moždanog udara

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ABSTRACT

Objective. To measure trends in CVD, acute myocardial infarction (AMI), and MU morbidity and mortality, assessing the extent to which these trends are associated with changes in known risk factors (RF), daily lifestyle habits, health care, and major socioeconomic characteristics. Measurements were carried out at the same time in defined communities in different countries on several inhabited continents.

Methods. MONICA combined the old with the new, routine standardized measurements of epidemiological parameter's, RF and medical care were combined with quality control and publication of results on the internet, hypothesis testing and publication of study results in prestigious scientific journals. The hypothesis couldn't be tested only on one population and without cooperation with the WHO, and the main activities were recording the incidence of AMI and stroke, coronary care, analysis of population samples and implementation of the intervention program. Incidence, morbidity, lethality and mortality of stroke, sociopolitical and economic characteristics, as well as stroke RF in the area of Novi Sad were investigated from 1979-1983-2002, in order to establish and implement the aforementioned protocols.

Results. The levels and distribution of the main RF that determined the undertaking of preventive activities and the implementation of intervention programs to protect residents from CVD are presented. The results of the MONICA project

APSTRAKT

Cilj. Merenje trendova u morbiditetu i mortalitetu od kardiovaskularnih bolesti (KVB), akutnog infarkta miokarda (AIM) i miokardne insuficijencije (MU), procena stepena u kojem su ovi trendovi povezani sa promenama poznatih faktora rizika (FR), svakodnevnih životnih navika, zdravstvene zaštite i glavnih socioekonomskih karakteristika. Merenja su sprovedena istovremeno u definisanim zajednicama u različitim zemljama na nekoliko naseljenih kontinenata.

Metode. MONICA su kombinovale staro sa novim, rutinska standardizovana merenja epidemioloških parametara, FR i medicinska nega su kombinovani sa kontrolom kvaliteta i objavljivanjem rezultata na internetu, testiranjem hipoteza i objavljivanjem rezultata studije u prestižnim naučnim časopisima. Hipoteza nije mogla biti testirana samo na jednoj populaciji i bez saradnje sa SZO, a glavne aktivnosti su bile evidentiranje incidencije AIM i moždanog udara, koronarna nega, analiza uzoraka populacije i sprovođenje programa intervencije. Incidencija, morbiditet, smrtnost i mortalitet od moždanog udara, sociopolitičke i ekonomske karakteristike, kao i FR moždanog udara na području Novog Sada ispitivani su od 1979-1983-2002. godine, kako bi se uspostavili i sproveli gore pomenuti protokoli.

Rezultati. Predstavljeni su nivoi i distribucija glavnih RF koji su odredili preduzimanje preventivnih aktivnosti i sprovođenje interventnih programa za zaštitu stanovnika od kardiovaskularnih bolesti (KVB). Rezultati projekta MONICA u Novom Sadu

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in Novi Sad were achieved by reducing the epidemiological indicators of stroke in a period of favorable social, political and economic conditions, and by worsening them in the opposite circumstances in all expressed aspects of people's lives and state functioning.

Conclusion. The hypothesis has been proven that the social community achieves a successful final mission of reducing stroke rates of morbidity and mortality by undertaking prophylactic measures, so that despite the development of reperfusion therapies for patients with acute ischemic stroke, prevention remains the approach of choice for reducing the its risk.

Key words: cardiovascular diseases; stroke; risk factors; epidemiology; surveillance.

INTRODUCTION

Epidemiology of stroke, risk factors (RF) in its occurrence and analysis of social, political and economic characteristics in the area of the urban community of Novi Sad has been researched since 1979, with the monitoring of trends and determinants of cardiovascular diseases (MONICA program) since 1983. The implementation of the prophylactic project lasted for the next 20 years, until 2002. The research was conducted on a representative sample of the population of 286,000 to 299,300 working age population aged 25-64 from 1983 to 2002.

The prerequisites for the successful implementation of preventive measures in preserving people's health are the presence of awareness of each individual and the entire public in the social community about the necessity of leading and maintaining a healthy lifestyle, the establishment of a good standard of living and the application of basic diagnostic and prophylactic procedures, in order to achieve the goals set out in the subject debates related to the reduction of morbidity and mortality rates from cardiovascular diseases and stroke.

For the successful implementation of the prevention of such a complex and dangerous human health condition as a stroke, cooperation with the international community and state administrative centers is necessary in order to achieve the foundations for providing and undertaking quality leadership, scientific, financial and professional assistance. The MONICA program contains precisely defined objectives, measures and measurement techniques for obtaining data focused on risk factors. The prerequisites for its implementation were the organization of health services in the community, the support and cooperation of the entire community, the assumed responsibility of each individual for their own health and the implementation of prevention by people under the supervision of medical personnel. Preventive measures consisted of detecting and treating arterial hypertension and diabetes mellitus, reducing the number of smokers, implementing healthy eating measures, increasing the number of physically fit people,

postignuti su smanjenjem epidemioloških indikatora moždanog udara u periodu povoljnih društvenih, političkih i ekonomskih uslova, a njihovim pogoršanjem u suprotnim okolnostima u svim izraženim aspektima života ljudi i funkcionisanja države.

Zaključak. Dokazana je hipoteza da društvena zajednica postiže uspešnu konačnu misiju smanjenja stope morbiditeta i mortaliteta od moždanog udara preduzimanjem profilaktičkih mera, tako da uprkos razvoju reperfuzionih terapija za pacijente sa akutnim ishemijskim moždanim udarom, prevencija ostaje pristup izbora za smanjenje njegovog rizika.

Ključne reči: kardiovaskularne bolesti; moždani udar; faktori rizika; prevencija; epidemiologija; nadzor.

reducing the number of obese people and lowering the average cholesterol level in the population. The epidemiology of stroke was successful in the period of satisfactory stated circumstances during the first 10 years of implementation of the prophylactic MONICA program of WHO (1983 - 1991/2), and after its collapse due to the disintegration of the social-state community and the imposed sanctions of the international community directed against the satisfactory standard of living of people and of the functioning of the state, during the next 10 years (1992/3 - 1995 - 2002), it drastically worsened, i.e. it was correlated with the researched risk factors, quality of care, diagnostic and personnel possibilities, treatment and the influence of socio-political and economic circumstances.

Stroke is a great medical problem because it can be debilitating or deadly. The best defense is to prevent a stroke, or make diagnostic's hurry, and make's treatment as soon as possible. As a health problem, stroke has been followed worldwide in many countries for more than several decades. Through its WHO cross-sectional study program launched the beginning of preventive cardiology and neurology in vascular pathology and presented the first data on populations exposed to CVD RF. The formation of a registry of stroke patients, as part of the information system contained in epidemiological studies, represents the necessity and possibility of further studying the conditions in which a person becomes or remains ill or disabled. Based on the data contained in the register, all data are collected and analyzed, which are the basis for any further attempt to reduce the number of patients by applying appropriate prophylactic measures. In many countries, the WHO has been monitoring trends in the occurrence and epidemiological stroke parameters for a long time in the context of the application of prophylaxis. In the middle of the 20th century, stroke rates of incidence and mortality in many countries were alarmingly high, and with the application of preventive measures, they were significantly reduced.¹⁻³ Despite great research and scientific efforts, many epidemiological questions of cardiovascular, coronary and cerebral morbidity and mortality remained without satisfactory answers, so the monitoring of

trends and determinants of CVD - the WHO MONICA project was started in 1979 in Bethesda, in an attempt to answer these questions and they finally decided. Despite the establishment and development of reperfusion therapies for patients with acute ischemic stroke, well-implemented prevention remains the best approach to reduce the risk of stroke.⁴⁻⁹

The objectives of the study were to measure trends in CVD, acute myocardial infarction (AMI), stroke morbidity and mortality to assess the extent to which they are related to changes in known RF, daily life habits, health care and main socioeconomic characteristics, measured at the same time in defined communities in different countries on several inhabited continents. MONICA IUG-NOS 49 - Novi Sad Collaborative Center (MCC NS) was the only participant in the WHO MONICA project, both in the former Socialist Federal Republic of Yugoslavia (SFRJ) and in the latter FRY.^{5,7,12} The aim of the work was to determine the socio-political and economic influences on the stroke epidemiology in Novi Sad during the implementation of the preventive WHO MONICA program.^{5,7,10-13}

MATERIAL AND METHODS

On the territory of Novi Sad, the capital of the Autonomous Province of Vojvodina (APV), a multi-ethnic and multi-cultural social community with more than 20 different nationalities and about 20 confessional communities, participation in the international Comprehensive Integrated Program was organized among working-age residents (25 to 64 years old) for non-communicable diseases (CINDI) in 1979, then the MONICA program started from 1983 to 2003. The project involved personnel and equipment from several hospitals and medical centers, as well as university medical schools. Novi Sad is included in the WHO MONICA program due to the documented highest rates of CVD mortality in SFRY registered in Vojvodina, before the start of the project. Measures and measurement techniques to obtain the necessary data on the number of smokers, the content of fat, sugar and salt in the daily diet, the number of physically active people and people who play sports, the number of overweight people, early detection of hypertension and patients with hypercholesterolemia, their adequate treatment and behavioral characteristics of the population were determined by the protocol of the MONICA project.^{12,13} Registration and monitoring of classical RF for the mentioned diseases and pathological conditions, application of preventive measures and standardized procedures of their epidemiological monitoring were carried out simultaneously in 37 populations per 10 million inhabitants on four populated continents (all except Africa) in a period of 20 years. During the research period, the accuracy of the measurements carried out in the research centers was compared and it was found that in relation to diabetes, hypercholesterolemia and obesity, it's in accordance with the expected results according to the hypothesis, while it's improved for the RF of smoking and high blood pressure.^{12,15-21}

RESULTS AND DISCUSSION

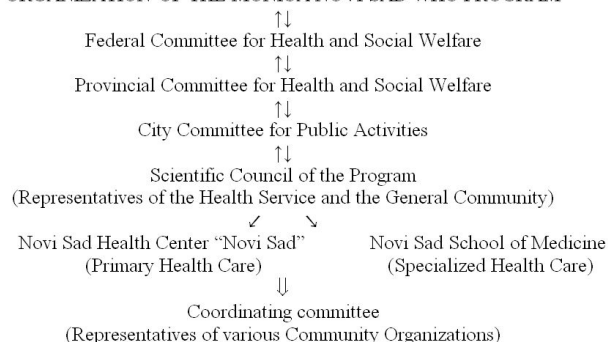
In the territory of Novi Sad, from 286,000 inhabitants in 1983 to 299,300 inhabitants in 2002, the prophylactic WHO MONICA project for AIM and stroke was implemented for a period of 20 years. The initial results through the implementation of a well-organized preventive program were encouraging (Appendix 1), the response of the population to the preliminarily conducted research on the presence of RF was very good (Table 1).^{1,14,19,21} It was a preliminary study in preparation for the implementation of the most extensive research study of CVD and stroke in the world, which was started in Novi Sad and carried out to the end (Tables 2-4). The time until 1989 was stable in SFRY including and in APV, and prosperous in the economic, political and social sense and provided good conditions for the implementation of health care. Before the introduction of UN economic and political sanctions (1983-1992), the incidence of stroke decreased from 268 to 214/100,000 inhabitants over 24 years of age (12%). The mortality rate was reduced from 67.1 to 49.9/100 new patients at the one-year level (21%). Since 1990, the socio-political and economic conditions have worsened, which has resulted in the worsening of the health condition of the residents of the former Yugoslavia, by default also the residents of Novi Sad (Appendices 2-3). Due to the civil war in the country, the UN imposed sanctions on Serbia in 1992 that were in force until the end of the war in 1995, from which only the WHO's MONICA program was exempted, but the worsening conditions for its implementation contributed to a drastic deterioration of the monitored epidemiological results (Figures 1-7). The epidemiology parameters of stroke in the population of Novi Sad have worsened, which is also suggested by statistical data on the main RF in correlation with the gross national product (GNP).²¹⁻²³ During the sanctions (1992-1995) the incidence increased from 214 to 299 (26.6%), and the mortality rate on average increased from 49.9 to 50 (2.7%). The supply of medicines was insufficient and daily life stressful despite previously proven medical skills and knowledge. The stroke prevention program couldn't be successfully completed due to the period of socio-political and economic crisis during its implementation. After the collapse of the SFRY and the end of the civil war, the UN sanctions were lifted on the FRY in 1995 and the MONICA project was extended for another 10 years for the collaborating centers that accepted it, among which was YUG NOS-49, MCC NS, but the situation became drastically worse after the aggression of the North Atlantic Treaty Organization on FRY in 1999.^{14,21,23} However, the prophylactic program was functional at the international level in full swing so that, according to the Web of Science (WoS) internet search register, in the period 1996-2024 (March 11), a total of 3,421 WHO MONICA papers were published, cited in 147,369 professional and scientific publications, with a total of 157,467 heterocitations.

CONCLUSION

Stroke isn't a disease in itself (*sui generis*) but a secondary condition of untreated and advanced FR as the cause of its occurrence. Many unfavorable circumstances of life in modern social communities also contribute to its appearance, the disastrous consequences of which represent a tragic entrance and outcome for every ill, their families and the community as a whole. The analysis of the stroke epidemiological parameters suggests that during the clinically advanced stages of the disease, even the most sophisticated treatment gives only moderately satisfactory results, and that prevention through the implementation of early detection and treatment of RF, the application of hygienic and dietary measures of everyday life, with the systematic implementation of expertly guided monitoring of the health status of people in the community, represents the approach of choice and the way to suppress the risk and prevent the stroke occurrence.^{1,5,7,13,24} The prevalence of major risk factors for stroke, mainly in terms of hypertension and atrial fibrillation, so the impact of stroke is still substantial and sustained public health interventions and awareness campaigns for risk factor reduction. At the same time, preventive measures must be implemented by people, because stroke isn't contagious, only the inadequate lifestyle habits of the future victims of this vicious health scourge are contagious. In the first ten years of the Project, stroke rates of morbidity and mortality were reduced by about 20%, and in the later period, under the burden of sanctions from the international community, with the resulting drastically worse socio-economic conditions, the favorable trend of the stroke epidemiology was reversed and the rates morbidity and mortality continued to increase.^{7,13,14,23} The results achieved within the framework of the Novi Sad MONICA project, by reducing the stroke rates incidence and mortality in a period of favorable social, political and economic conditions, prove that taking prophylactic measures in the social community achieves a successful final mission. The health service of Novi Sad successfully passed the strict criteria, it was highly rated for the quality of the conducted research, which passed the final analysis, hypothesis testing and was published in the most prestigious international journals.^{5,8,24-26} The WHO MONICA project was the first, and until the beginning of the 21st century the only, multinational study reported on geographical variations in stroke incidence using uniform criteria.²⁷

Appendix N°1

ORGANIZATION OF THE MONICA NOVI SAD WHO PROGRAM



Appendix N°2

SOCIOPOLITICAL AND ECONOMIC CIRCUMSTANCES

Outline of political events

- 1989 - Stable political and economic situation
- 1990 - Exaggerated claims made in advertising and media material for restructure of structure of the country
- 1991 - Secession and separation of Slovenia and Croatia with consequent war operations
- 1992 - Withdrawal of Yugoslav Army from Macedonia and seceding of Macedonia.
- War begins in Bosnia.
- UN Sanctions imposed.
- After the former SFRY has collapsed, a new state was established - FRY
- 1993 - Monetary-economic disaster in FRY resulting in unprecedented hyperinflation
- 1994 - 1995 Recovery in terms of monetary-economic and political terms were very gradual

Appendix N°3

EQUIPMENT, SPACE AND STAFF AT THE STROKE DEPARTMENT OF THE NOVI SAD NEUROLOGY CLINIC

- 1983 - A-mode Doppler-ultrasound for neurovascular examination,
to indications Computed Tomography (CT) scan,
X-ray angiography,
Five executive neurologists
- 1986 - previously plus B-mode Color Doppler (CD-duplex) ultrasound scanner,
Transcranial Doppler ultrasound (TCD),
Spectral analysis of Doppler signals,
Reconstruction of intensive care unit
- 1989 - all previously plus in total six executive neurologists
- 1995 - all previously plus Magnetic resonance imaging (MRI),
MR angiography (MRA), and

MR spectroscopy (MRS)

- 1996 -all previously plus in total nine executive neurologists and three young
Doctors of medicine specializing in neurology
- 1999 - all previously plus reorganization of the work of the neurological service
at two different locations in two hospitals
- 2000 - 2002 all previously plus in total twelve executive neurologists and the return of
work at one location - at the Neurology Clinic in Novi Sad

Table 1. The mean values and standard deviations (SD) of systolic and diastolic blood pressure (mmHg) in the population of NS aged 25-64.

Year	Men		Women	
	Mean	SD	Mean	SD
Systolic				
1976	135.3	20.7	140.8	23.2
1984	133.2	17.3	130	19.6
Diastolic				
1976	86.9	10.7	87.4	11.9
1984	84.2	10.8	81.7	10.6

Table 2. Distribution of risk factors in the sample of Novi Sad inhabitants. MONICA 1984.

MONICA 1984	N	%
Hypertension 21.3/12.7+ kPa	408	25.8
Hypercholesterolemia 6.7+ mmol/L	214	13.5
Hyperglycemia 5.6+ mmol/L	53	5.1
Smoking 5+ cigarettes/daily	625	39.5
Obesity 27.0+ BMI	688	43.5
Daily drinking ml	137	8.6

Table 3. Distribution of risk factors in the sample of novi sad inhabitants. MONICA 1988.

MONICA 1988	N	%	Mean	Variance	CD	CV
Hypertension (N=1556)	422	27.00	17.97	6.72	2.60	14.46
Hypercholesterolemia (N=1556)	614	39.13	6.20	1.68	1.30	20.94
Hyperglycemia (N=1270)	324	20.65	5.17	2.62	1.63	31.52
Smoking (N=1556)	654	41.70	20.43	132.70	11.53	56.42
Obesity (N=1556)	698	44.50	26.76	20.20	4.50	16.81

CV-coefficient of variation, CD-coefficient of dispersion

Table 4. Distribution of risk factors in the sample of Novi Sad inhabitants. MONICA 1994.

MONICA 1994	N	%	Mean	Variance	CD	CV
Hypertension (N=1554)	519	33.40	17.89	8.98	3.00	16.75
Hypercholesterolemia (N=1270)	461	36.30	6.12	1.69	1.30	21.25
Hyperglycemia (N=1270)	342	26.93	5.54	4.71	2.18	39.33
Smoking (N=1554)	655	42.14	21.48	88.72	9.42	17.88
Obesity (N=1270)	586	46.14	26.94	23.18	4.82	16.81
Daily drinking (N=1554)	204	13.13	-	-	-	-

CV-coefficient of variation, CD-coefficient of dispersion

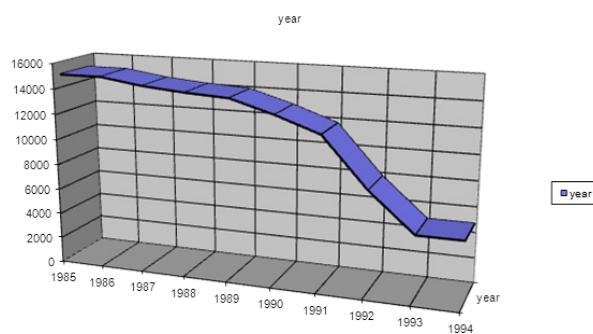


Figure 1. Gross National Product (GNP) in Vojvodina for a period 1985-1994 (mil. YUD); correlation between GNP in Vojvodina and stroke incidence for period 1985-1994 (mil. dm), Gross National Product (Gnp) correlation= - 0.26922; correlation between GNP in Vojvodina and stroke lethality for period 1985-1994 (mil. dm), Gross National Product (GNP) correlation= - 0.25054, correlation between GNP in Vojvodina and stroke mortality for period 1985-1994 (mil. dm), Gross National Product (Gnp) correlation= - 0.47309.

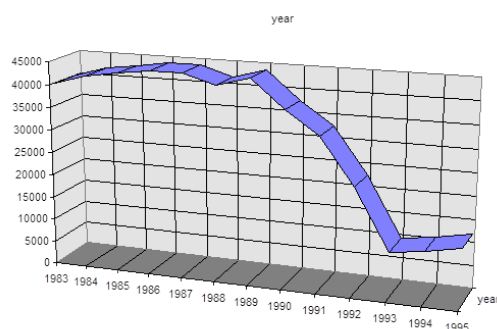


Figure 2. Gross National Product (GNP) in SFRY for the period 1983-1995 (mil. YUD); correlation between GNP in SFRY and stroke incidence for period 1983-1995 (mil. dm), Gross National Product (GNP) correlation= - 0.54473; correlation between GNP in SFRY and stroke lethality for period 1983-1995 (mil. dm), Gross National Product (GNP) correlation= - 0.16536; correlation between GNP in SFRY and stroke mortality for period 1983-1995 (mil. dm), Gross National Product (Gnp) correlation= - 0.36199.

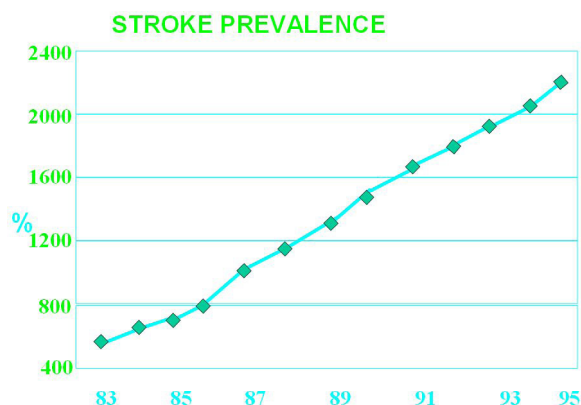


Figure 3. Stroke prevalence, during the project follow-up.



Figure 4. Stroke mortality, during the project follow-up.

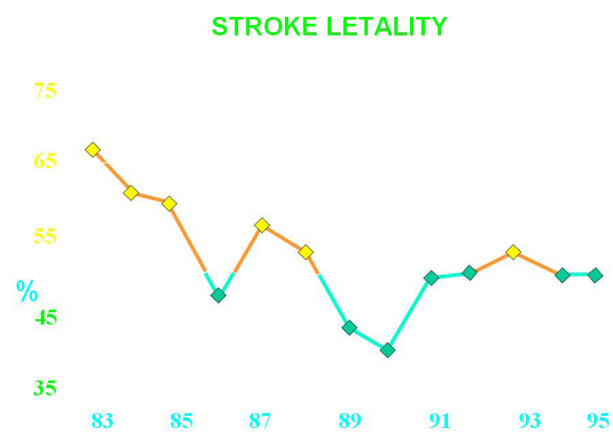


Figure 5. Stroke lethality, during the project follow-up.

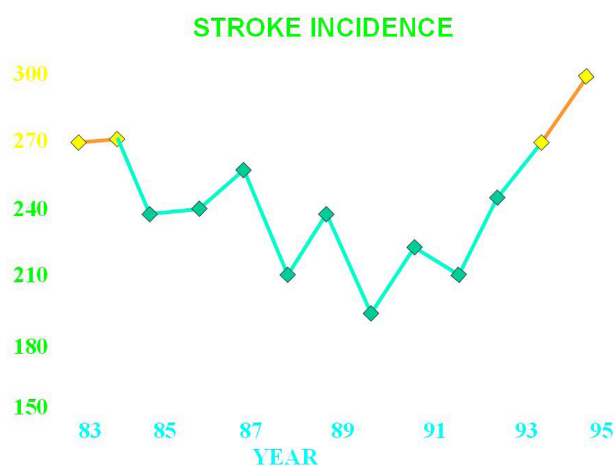


Figure 6. Stroke incidence, during the project follow-up.

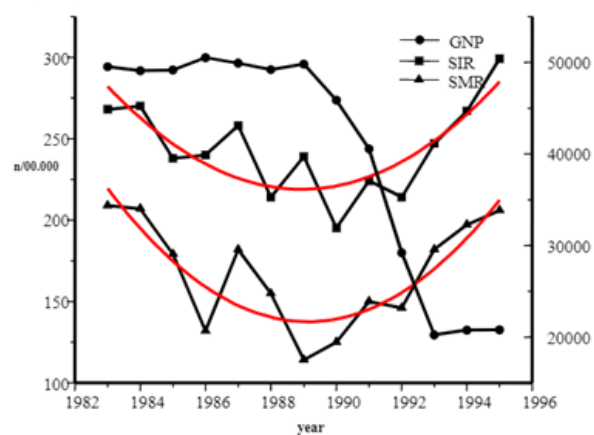


Figure 7. Relation between Gross National Product (GNP), Stroke Incidence Rate (SIR) and Stroke Mortality Rate (SMR) from 1983 to 1995 year.

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