

AN OVERVIEW OF THE 1969-2007 FOLLOW-UP STUDY OF CHRONIC DISEASES AND HEALTHY AGEING IN CROATIA AND PERTINENT PUBLICATIONS

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This article brings an overview of data collected in a follow-up study of chronic diseases in general adult population residing in inland and coastal Croatia, that was performed from 1969 to 2007. Despite the selection bias, the sample of volunteers examined in the last follow-up (2005 - 2007), now older than 70, remained as representative as in the previous three follow-ups (1969, 1972, and 1982). Here we report on the design of this prospective cohort study and on papers that have been published as a result. The obtained data could help in promoting healthy living and longevity. The results of our survey might also contribute to the development and implementation of national or international strategies and action plans intended to reduce health risks, and particularly to control and prevent chronic diseases.

KEY WORDS: *adult population, cardiovascular disorders, elderly population, publications, respiratory disorders, selection criteria*

Mortality is the most common indicator of ill health. Death rates attributable to the majority of chronic diseases increase exponentially with age. In Western countries, about two thirds of all deaths in persons aged 65 and above are caused by four conditions: heart disease, cancer, stroke, and chronic respiratory disease. However, data on death rates and causes of death do not provide a full insight into the diseases affecting the elderly. An important indicator of ill health in the elderly is morbidity, in particular co-morbidity, i.e. a simultaneous presence of multiple chronic conditions. The five most common chronic conditions found among the elderly in Western populations include arthritis, hypertension, coronary heart disease, hearing impairment, and cataracts. Even in Western countries, diagnostics and registration of a number of conditions (e.g. dementia and other mental health problems) is difficult in general population, so the rates are probably underestimated. The WHO

encourages research of morbidity and mortality attributable to chronic respiratory and cardiovascular diseases, with the particular focus on known health issues such as diet, physical activity, and obesity. Populations in developed countries are becoming older.

The process of global ageing has a number of social implications, including increasing demands imposed on social security systems, pension funds, and healthcare systems. There is an urgent need for better understanding of the process of healthy ageing and its determinants. Comparing populations with healthy vs. less healthy ageing is one of the ways to identify factors that affect the process of population ageing. There is no universal definition of healthy ageing, but most people agree that the advanced age is associated with high rates of many chronic conditions and mortality and with a decline in physical and cognitive functions.

Little is known about morbidity, co-morbidity, and healthy ageing in the elderly in Croatia and other Central and Eastern European populations. Specific surveys are needed to provide reliable estimates of the frequency of such conditions.

Our study has followed up the prevalence and progression of chronic diseases through the progression of functional impairments. Its aim was to compare risk factors known to affect healthy ageing, and which are present in various socio-cultural environments of the inland and coastal Croatia.

Here we report on design of this prospective cohort study and on papers that have been published as a result.

STUDY DESIGN

The survey started as a research of regional prevalence and incidence of chronic bronchitis and asthma in Croatian general adult population (1). It was started in 1968 by the Croatian Central Bureau of Statistics and randomly recruited volunteers from the 1967 list of voters, as follows: one of nine men and one of 12 women were recruited from Zagreb, one of 11 men and one of 15 women in Split, one of eight men and one of eight women in Virovitica, and one of three men and women in Omiš and Vis. They were residents of inland and coastal districts, and stratified by age and sex. There were four cohorts of middle-aged Croatian residents [(35 to 55) years old in 1969]. The aim was to obtain and compare the prevalence and the incidence of chronic bronchitis and asthma in urban vs. rural, and coastal vs. inland Croatian population. Additionally, at every visit we conducted medical checkups which included completing a questionnaire adjusted to the International Classification of Diseases, 9th revision (ICD 9), spirometry, anthropometry (1), electrocardiography (ECG), and blood pressure measurements. Occasionally we collected relevant lifestyle data, including pension income.

The study was designed according to the British Council statement on chronic bronchitis (2), and the volunteers examined in 1969 were invited to participate in the checkup scheduled for two years later (in 1972).

The survey continued in 1982 as a study of chronic diseases, lung health, and lifestyle habits (smoking, alcohol and coffee consumption, and salt intake) in volunteers who had been examined on previous visits in 1969 and 1972. The subjects underwent ECG

to establish any presence of arterial hypertension and chronic cardiovascular illnesses, and were also interviewed using a questionnaire on lung health and eating habits.

Starting from 1982, we had been analysing vital data, and since 1996 we had been using Cox regression for survival modelling (Figure 1). Consequently, our longitudinal survey has yielded a number of publications (3-77).

Our follow-up conducted between 2005 and 2007 included the data on vital status, residence, and health. The contact was made by post, by phone, or by inspection of medical and vital records, and finally at signing the informed consent form, just before the last visit.

The longitudinal study on healthy ageing was based on data related to subjects who made the last visit (N=396, Table 1). In part, the study also relies on the data collected through 1982 (lifestyle, nutrition).

The checkups carried out in 1969-1972 and 2005-2007 were performed in the same manner. Medical history was obtained with the questionnaire adjusted to ICD 9 (Figure 1). The interviews and the checkups were performed by a team of trained medical doctors, whereas nurses conducted spirometry, ECG, anthropometry, and blood sampling. Data were coded to preserve the subject's right to privacy and were processed for statistical purposes.

The aim of the 2005-2007 checkups was to re-examine the remaining mobile, self-supporting volunteers, who were divided into two age groups: (70 to 74) years and (75 to 90) years. They were further divided according to urban vs. rural residence in order to see if there were any differences between them in relation to the history of chronic, non-communicable diseases, mainly of the lung, cardiovascular system, and metabolism. These checkups included a mental health questionnaire, quality of life and lifestyle assessment, collection of data on marital status, sleeping hours, and mobility as parameters of healthy ageing. The incidence of senile cataracts and prostate tumours, and the results of isopropyl alcohol sniff test were also recorded. These data were used to establish inter- and intraindividual differences from the results obtained in 1982.

AN OVERVIEW OF PUBLISHED DATA

This overview brings into one place research results gathered through PubMed/Medline and Web

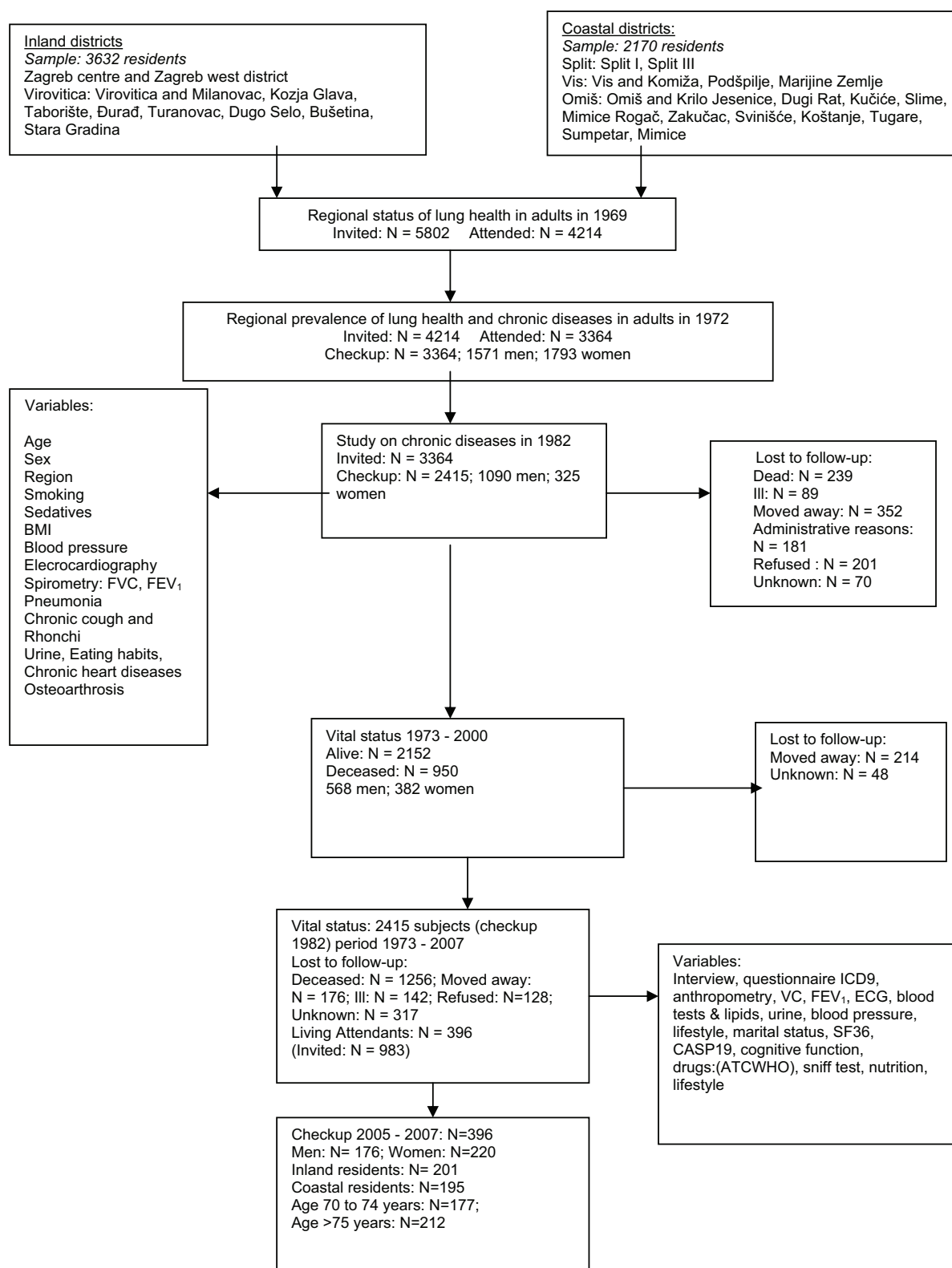


Figure 1 Flow chart of the 1969 - 2007 longitudinal study

of Science indexing services and the Croatian science web portal HRCĀK. Twenty papers were related to the chronic lung disease (3, 5, 9, 16, 19, 24, 27-29, 31, 32, 38, 41, 50, 52, 56, 66, 70, 72, 77) and 31 to cardiovascular issues, mostly to arterial hypertension and changes in ECG (4, 6, 8, 10, 11, 13, 15, 17, 33, 35, 36, 37, 39, 45-49, 53-55, 57, 58, 61-63, 67-708, 75). Chronic diseases affecting joints and skeletal system were described in 11 papers (7, 18, 20, 21, 34, 43, 51, 64, 65, 71, 76). Other chronic diseases and complaints were in 12 articles (12, 14, 22, 23, 25, 26, 30, 40, 59-61, 73). Some of the articles deal with the survival rates (11, 12, 14, 16, 58). Various sub-population studies were included in a number of postgraduate theses (66-77).

Fifty-six papers were published in Croatian and 17 in English. Medline indexed 40 articles published in Croatian journals (of which 13 in the *Archives of Industrial Hygiene and Toxicology*). ISI Web of Knowledge (Web of Science) reports 51 citations of articles referred to above (ranging from 1 to 4 per article). Papers on cardiovascular morbidity issues were cited 14 times, while those on chronic respiratory diseases were cited seven times (in journals whose impact factor ranged from 0.006 to 2.933).

This follow-up study has several strong points; it started early and involved state-of-the-art data processing methods; it contributed to better understanding of chronic cardiovascular and respiratory diseases in Croatia and former Yugoslavia; it anticipated the issues related to air pollution and its effects on the incidence and prevalence of chronic bronchitis in Croatia; and finally; its data have served well for survival analysis, and they keep up with international research.

This longitudinal project had a significant influence among epidemiologists and specialists in cardiovascular and respiratory diseases, and has contributed to better understanding of chronic diseases in the Croatian population. Similar studies, intending to take a longitudinal course, have been carried out

under the wing of the Ministry of Health and Social Welfare of the Republic of Croatia (the 1st Croatian Health Project), as are the projects covering the topics from general and biological anthropology and gerontology domains.

Studies on mortality and morbidity have shown variability related to the residence of subjects. Some aspects of mortality and morbidity were more pronounced in inland districts. The results obtained from research carried out so far suggest that differences in lifestyle are the main reasons for differences in the occurrence of chronic diseases between the residents of inland and coastal Croatia. The research has also shown a change in lifestyle trends and in the incidence of chronic diseases in the surviving subjects. In fact, this group counts but a few current or former smokers. This corroborates the results of our previous survival analysis, which singled out smoking as a major risk factor (16, 77).

However, subjects older than 70, examined in 2005-2007, show a high incidence of metabolic disorders such as obesity, hyperlipidemia, hypertension, and diabetes. Results suggest that the incidence of metabolic disorders is almost equal between survivors from the coastal and inland Croatia. Likewise, no substantial difference was found between urban vs. rural surviving population.

Differences in the prevalence of chronic diseases are contributed to differences in healthcare quality between rural and urban districts of Croatia. The latter tended to provide better healthcare.

We believe that the results to be obtained from the last study stage will also contribute to better understanding of differences in healthy ageing due to geographical distribution, sex, and morbidity of Croatian population. Identifying frequent chronic diseases and causes of death can influence healthcare policymaking. The results obtained in this study could help in promoting healthy living and longevity, provided that individual variables could be validated as risk or protective factors. The results of our

Table 1 Inclusion criteria for the study of healthy ageing

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- the subject has completed all visits;
 - the subject remained within 20 km from the 1982 residence;
 - the subject does not live in a nursing home;
 - the subject is not a resident of a location directly engaged in 1991-1995 war operations
 - the subject is mobile and self-supporting;
 - the subject did not report acute illness and could be reached for medical checkup;
 - the subject was not totally blind and could hear relatively well to participate in the interview and talk to the study staff
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survey might contribute to the development and implementation of national or international strategies and action plans intended to reduce health risks, and particularly to control prevent chronic diseases.

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*Sažetak***PRAĆENJE POJAVNOSTI KRONIČNIH BOLESTI I ZDRAVOG STARENJA U HRVATSKOJ OD 1969. DO 2007. – PREGLED PLANA PRAĆENJA I PRIPADAJUĆIH PUBLIKACIJA**

Opisan je tijek studije o učestalosti kroničnih bolesti u općoj populaciji u Hrvatskoj. U članku se raspravlja o posljednjem pregledu (4. valu) studije provedenom 2005. do 2007. na sudionicima koji su sada stariji od 70 godina. Usprkos selekcijskoj pristranosti (bias) te prirodnom gubitku ispitanika zbog neodaziva na pregled, uzorak je ostao reprezentativan s obzirom na ranije preglede provedene u 1. do 3. valu studije. U članku je naveden popis objavljenih radova proisteklih iz dosadašnjeg istraživanja na istom uzorku populacije. Rezultati studije mogli bi pomoći u promociji zdravog starenja i ukazati na individualne protektivne i rizične zdravstvene čimbenike, a ujedno pridonijeti razvoju nacionalnih i međunarodnih strategija čiji je cilj smanjenje zdravstvenih rizika, naročito u kontroli i prevenciji kroničnih bolesti.

KLJUČNE RIJEČI: *dijagram toka, kardiovaskularni poremećaji, kriteriji selekcije, odrasla populacija, publicistika, respiratorni poremećaj, starija populacija*

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