Croatian Adult Health Survey – A Tool for Periodic Cardiovascular Risk Factors Surveillance

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A B S T R A C T

National risk factors surveys present very important tool for gathering population based health related information for policy. Croatian Adult Health Survey (CAHS) is such a tool, intended to collect population-based, representative and authoritative information on cardiovascular risk factors prevalence. The CAHS sample was designed to provide nearly complete coverage (98%) of the Croatian adult population, based on the random selection of the adult member of the household that was selected in the complex sampling scheme. Additionally, seven-step weighting scheme was applied to the dataset, in order to further increase the representativeness of the sample which is consequently considered to be representative for six geographical and administrative regions of Croatia, while it is considered only to be informative for the county-based estimates. The first cycle of the project took place in 2003, with a total of 9,070 respondents. The second project cycle is taking place in 2008. It has now been converted into the follow-up study (re-surveying the 2003 sample) and is being further supplemented with additional questions, qualitative investigation module and an intervention performed by the public health nurses. The CAHS provides not only the basis for health information for policy, but also serves as a platform for a number of ongoing public health collaborations and a valuable public health research resource.

Key words: Croatian Adult Health Survey, surveillance, risk factor, cardiovascular, health policy, Croatia

Introduction

One of the main requirements for the optimal performance of the health systems is reliable information on which decisions and policies can be made. Often this type of decisions is based on the morbidity or mortality data, which is generally sufficiently informative as well as reliable. However, some health care actions, especially those in disease prevention and health promotion have to be based on the more proximate information and intermediate health outcomes, namely prevalence of various risk factors and health-related behavior patterns including e.g. smoking, dietary patterns and physical (in)activity.¹⁻⁴

A large overview of the national risk factor surveys indicated that the methodological background, basic approach as well as the survey composition largely varied across Europe.¹ Not only this, but the number, dynamics and the extent of such surveys that are being carried out across these countries also varies¹, possibly reflecting the financial opportunities and the overall awareness on importance of the risk factors surveillance. Among the 67 surveys that were compared, the authors found substantial differences, often making comparisons between or among countries difficult or impossible.¹ However, the main conclusion of this line of research is that the cardiovascular risk factors have substantial contribution to the overall morbidity and mortality, making them an interesting target for information collection and the development of various health interventions.⁵

Setting

Croatia is a country of marked geographic and cultural diversity. It consists of a continental and coastal part, as well as some mountainous regions. Each of these regions is characterized by different cultural habits as well as the complexity of lifestyle patterns, producing a unique mixture within one country. One of the most famous and widely repeated differences is the »unhealthy East« paradigm, suggesting that inhabitants of the conti-

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nal parts of the country (primarily Eastern parts, Slavonia) are more inclined towards fatty diet with less vegetables intake and the overall «unhealthy lifestyle», than those in the costal parts (Dalmatia). Additionally, the 1991–1995 war has caused substantial changes in the demographic structure and the overall health status of the population, marked by the substantial destruction of the infrastructure and large number of displaced persons6–7. One of the first problems within the health system after the war was the lack of information that could be used to create and organize the appropriate health care delivery to the population. This prompted the Ministry of Health and the Croatian Health Insurance Institute to undertake a large project that would collect such information. The first national population based survey was initiated and conveniently entitled «The First Croatian Health Project». It provided the first post-war population based source of information for health policy, aiming to create a framework for developing a long-term strategy of public health planning, prevention and intervention8. The project took place in 1995–1997 and sampled over 10,000 individuals from 30 randomly selected settlements from all counties in Croatia, putting a strong emphasis on the local information dissemination. From this sample, a backwards procedure was employed, selecting a representative sub-sample of the Croatian population aged 18–65 on the basis of a hierarchical, stratified multistage design (N=5,840). Several serum measurements were measured from the blood sample that was taken from each respondent; cholesterol, HDL and LDL, triglycerides and fibrinogen. Additionally, detailed data on general knowledge and attitudes on health issues was collected, further supplemented by the information on smoking, alcohol consumption, dietary pattern, physical activity, family medical history and occupational exposures8. The only publicly available publication summarized these results8 and provided an overview of the general health status in the Croatian population.

Second population based survey employed a different sampling technique. Croatian Health Survey consisted of four different population groups, among which the «open» (=general) population was in the main interest focus9. The sampling was based on the stratified multistage sampling in four regions of Croatia. A random sample of health centers was made in each region, from which approximately 10% of the population in the general practitioners (insurance register) records was randomly selected, thus covering approximately 0.1 percent of the entire Croatian population. The selected individuals were then approached and interviewed in their homes by the trained interviewers. Data were collected from February 1997 to February 1999, resulting in the total of 5,048 respondents and the overall response rate of 96%. However, neither the Croatian Health Survey nor the First Croatian Health project were used for publication of more scientific articles or reports that are available in the public domain, resulting in the low amount of population-based information for policy.

Country Profile

Cardiovascular diseases are currently the leading cause of death in Croatia. In 2000 there were 26,712 cardiovascular disease related deaths, while in 2005 there were 26,029 of deaths, accounting for one out of every two deaths in Croatia10. Standardized mortality ratio of ischaemic heart disease and cerebrovascular disease in Croatia is among the highest in the region (Table 1).

#### Table 1

<table>
<thead>
<tr>
<th>Country</th>
<th>Ischaemic heart disease</th>
<th>Cerebrovascular disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Croatia</td>
<td>154.49</td>
<td>127.79</td>
</tr>
<tr>
<td>Austria</td>
<td>115.80</td>
<td>42.80</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>163.60</td>
<td>11.82</td>
</tr>
<tr>
<td>Slovenia</td>
<td>82.45</td>
<td>72.02</td>
</tr>
<tr>
<td>Hungary (2003)</td>
<td>232.66</td>
<td>134.37</td>
</tr>
</tbody>
</table>

Despite these figures, the current Croatian health care system does not put a lot of attention to the primary prevention of cardiovascular and cerebrovascular diseases, but focuses on those who already have symptoms of coronary heart disease or cerebrovascular diseases, encompassing activities in the secondary prevention. Activities in primary prevention, delivered to those who are at the greatest risk on contracting these diseases in the future are not developed as a well-designed preventive-educative system. Furthermore, there was no evidence base for developing policy on reducing the burden of cardiovascular disease and recommending interventions for people with cardiovascular risk factors11–13.

Croatian Adult Health Survey

**– Sampling and Coverage**

Croatian Adult Health Survey (CAHS) was initiated in 2001, in collaboration of Croatian Ministry of Health, Statistics Canada, Central Bureau of Statistics of Croatia and Andrija Stampar School of Public Health. The field work was carried out during 200314–16. Primary objectives of the CAHS were to provide timely, reliable, cross-sectional estimates in order to support the work around developing a public health information system, enhanced national efforts in health promotion with emphasis on cardiovascular disease prevention, cardiovascular disease risk reduction, clinical prevention and emergency care and to promote healthier lifestyles among the general population with emphasis on smoking prevention and cessation14. The sample was designed to cover the adult population of Croatia (aged 18 years or older), who were living in private dwellings (those who were living in...
non-conventional dwellings, clientele of institutions, full-
time members of the Croatia Armed Forces and resi-
dents of certain remote regions were excluded from this
survey, as well as the district of Brezovica in the city of
Zagreb). The 2003 CAHS covered approximately 98% of
the Croatian population aged 18 or older\textsuperscript{14}. The sample
was designed to provide the representative estimates
from six regions of Croatia that were selected and grouped
on the basis of the counties (Figure 1).

Furthermore, each stratum (except city of Zagreb)
was divided in two sub-strata: town and municipality, in
order to obtain sample homogeneity and provide better estimates\textsuperscript{14}. According to these premises and taking into
account estimated non-responsiveness, sample was de-
dsigned on the basis of 11,250 households that were ac-
cordingly distributed in the higher level regional organi-
zation strata.

After identification of the household unit, one adult
inhabitant was to be randomly selected and included in
the study by using a vector of random numbers and based
on the number of eligible persons. The survey was carr-
ied out by 238 public health nurses from April 22,
2003 until the end of June\textsuperscript{14}. Public health nurses were
surveying in the regions where they usually work, ensur-
ing that non-responsiveness would be minimal. In an at-
tempt to further minimize non-responsiveness, an intro-
ductive letter signed by the Croatian Minister of Health
was presented to each selected household\textsuperscript{14}. All these ac-
tions contributed to the overall response rate of the
CAHS, which was 54.3%, with significant differences
among the six defined regions ($\chi^2=6.97$; $P=0.008$, compared to all other re-
gions in a pooled analysis), while the lowest response
rate was in the city of Zagreb with only 76.5% ($\chi^2=9.08$;
$P=0.003$). Furthermore, the entire sample was designed
on the basis of town and remaining county, enabling the
comparison of the response from these two regions. Ove-
 rall, the response was higher in remaining parts of coun-
ties than in towns (87.5% vs. 82.7%, respectively), but
the difference was not significant ($\chi^2=3.51$; $P=0.061$).
The CAHS sample also shows significant deviation from
the gender structure of the entire population, based on
the 2001 Census of population ($\chi^2=888.36$; $P<0.0001$).
The highest percent of men in the sample was recorded
in Southern Dalmatia (33.9%), while the least men re-
spondents were recorded in the city of Zagreb (29.7%),
although this difference was not significant ($\chi^2=8.73$;
$P=0.120$). These findings suggest that two sub-popula-
tion groups that were under-sampled were men and
those living in urban areas, while rural population seemed to be more prone to participation in this type of
study.

The CAHS sample was designed to provide represen-
tative estimates on the regional level, while on the county
level it is considered only to be informative (the same
goes for even lower geographical level, towns). This is
seen especially well in the case of Pozega-Slavonia and
Virovitica-Podravina Counties, which had the lowest con-
tribution to the CAHS sample, when this was compared
to the percent of the population living in those two coun-
ties (both counties had twice less respondents than ex-
pected, when the county sample size in CAHS was com-
pared to the county population count based on the Census
of population 2001 data). In contrast, two counties that
were obviously over-sampled were Koprivnica-Krizevci
and Lika-Šenj, with Koprivnica-Krizevci sample having
63% of over-sampling, compared to the expected county-
based sample size.

The sample breakdown into even lower geographical
units, towns, resulted in the formation of 85 units – clus-
ters (Figure 2). Among these, the CAHS cluster samples
were representative for gender composition in only 8
units, for age composition (according to four age groups –
18–34, 35–49, 50–64 and 65 and more) in 12, while for
both age and gender composition in only three units
(clusters for Dubrovnik, Krizevci and Zupanja). Thus,
the sample of CAHS is to be used with caution for any
geographical unit lower than the six regions defined as
the groups of counties. This in turn means that the use
for the county or town level the data can be considered
only informative, as the samples often show significant
deviations even from the age and gender structure of
each sub-population.

Finally, a complex, seven-step weighting scheme was
applied, further increasing the representativeness of the
sample, the method that is usually used in this type of the
study designs\textsuperscript{17,18}. Weighting scheme was adjusted to
reflect estimates for the entire population, meaning that
all the estimates from the CAHS sample are calculated
for the entire adult population of Croatia\textsuperscript{14}. The use of
the weighting scheme that also accounts for non-respon-
siveness puts CAHS in the group of better national sur-
veillance studies, as this was identified as one of the main
reasons for low usability and comparability of results.

Fig. 1. Geographic representation of the initial regions that were used to define the CAHS sample: 1 – Northern Croatia, 2 – Cen-
tral Croatia, 3 – Eastern Croatia, 4 – Western Croatia, 5 – South-
ern Croatia and 6 – The City of Zagreb.
from different surveys across Europe\textsuperscript{1}. The use of the complex sampling frame and the weighting method requires that all the analyses be performed with bootstrap variance estimation, in order for the results to be representative for either the six defined regions or entire Croatia\textsuperscript{14,19}. The use of the weighting also requires special variance estimation methods, which is obtained by the coefficient of variation (CV). Values of CV between 0 and 16.5 are considered to be acceptable, between 16.6 and 33.3 marginal, while those over 33.3 are considered unacceptable\textsuperscript{14}.

Another geographical classification was recently introduced into CAHS, based again on six regions within Croatia, but this time recognizing mountainous parts of the country as the separate region. This classification considers that parts of Primorsko-goranska, Lika-Senj and Karlovac counties form mountainous region, while Northern and Southern Dalmatia are merged into single, coastal region (Figure 3). Although this classification does not follow the county borders any more, it provides hypothetically better basis for any public health study and intervention, as the population of mountainous regions was until now dispersed in three counties, thus disabling the presentation of their health status and problems.

Public Health Importance

The direct benefit of the population based risk factor surveillance is obvious, for both public health as well as the overall health care provision. However, CAHS has another set of perhaps less tangible, but also very important benefits. The survey contained 12 question modules (Table 2), meaning that a large number of researchers and stakeholders would be interested in the study results, making them more valuable to the public health experts, as well as all those who are involved in broader scope of health and social welfare. Therefore, the CAHS provides the basis for ongoing research in public health, which has so far been used for a number of research articles and several doctoral theses\textsuperscript{13,20,21}. Results of the initial descriptive analysis were published in two different symposia on cardiovascular health and the most interesting ones were further expanded and published in the special issue of journal Acta Medica Croatica.

Besides this research potential of the CAHS, it also serves as the hub for networking in public health and for bridging the gap between researchers and public health practitioners. This is seen in a numerous occasions of collaboration between Andrija Stampar School of Public Health and Croatian National Institute of Public Health or County Institutes for Public Health. In this light it should also be noted that there is a post-graduate course at the Zagreb University Medical School that has been submitted to the Postgraduate Board and is currently under evaluation. The course will mainly cover the methodological issues related to performing and analyzing the results from the large population surveys. Other than postgraduate course, there were also several workshops on CAHS, aiming to provide training to individuals who are interested in analysis and interpretation of the results from CAHS. All these activities ensured that CAHS team would develop sufficient capacity for further research and the basis for ongoing surveys delivery. The core CAHS consists from the researchers from Andrija Stampar School of Public Health and Croatian National Institute of Public Health.

Future Directions

Undertaking of the project of this magnitude requires substantial financial and organizational effort. This is the reason why neither this nor majority of other surveys are being carried out on an annual basis\textsuperscript{1}. However, pe-
One way to broaden and increase the usability of the current study strategy could include the creation of the county-based representative sampling schemes. This idea has been suggested by several counties, mainly due to the fact that the health and public health systems are largely organized and run on the county level. The performance of the county-based surveys would have to rely on a detailed sample definition that would include a large number of respondents per county and require substantial financial support. The entire CAHS sample, if it was defined to be representative for county-based estimates would have to include well over 25,000 respondents, what would require a lot of organizational effort and substantial financial support. However, by doing this, each county could gain very valuable health information that could be used to design targeted changes in the way that health care is run and provide the basis for well-defined public health intervention programs.

One of the possible future directions for CAHS is linking with other population-based surveys of either commercial or governmental nature. This could be achieved via linking with e.g. several union-based surveys, which have a main focus on the expenses and social status of the population. Although the dynamics of these surveys is much faster, it could be interesting to compare the results from the national survey to those obtained by the local surveillance by the union members, in order to obtain reliable information. Finally, one of the best possible scenarios, especially if the preventive medicine and health promotion would be given more weight within health system, is turning the CAHS into the sustainable governmental survey that would be carried out on the regular basis (annually, bi-annually or every five years). Furthermore, a detailed comparative study on CAHS would enable that the results from CAHS can be compared or even

### TABLE 2
CROATIAN ADULT HEALTH SURVEY QUESTION MODULES

<table>
<thead>
<tr>
<th>Module</th>
<th>Description</th>
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<tbody>
<tr>
<td>Household</td>
<td>General information, including household size and age composition, number of rooms, income per household and urbanisation level</td>
</tr>
<tr>
<td>Socio-demographic characteristics</td>
<td>Age, gender, marital status, education, occupation and subjective estimation of socio-economic status</td>
</tr>
<tr>
<td>SF-36 questionnaire</td>
<td>Widely accepted survey, consisting of several dimensions, namely general health, activity limitations, mental and physical problems</td>
</tr>
<tr>
<td>Health care access and utilization</td>
<td>Detailed data on visits to physicians, specialists, dentists, etc; difficulties in accessing health care services, health insurance coverage</td>
</tr>
<tr>
<td>Chronic conditions, medication, preventive examination</td>
<td>Data on 21 self-reported disease and medication taking; several questions on preventive examinations and screening for cancer and other chronic diseases</td>
</tr>
<tr>
<td>Smoking</td>
<td>Everyday smoking including the possibility to calculate pack-years estimates, information on quitting attempts, exposure to second hand smoke</td>
</tr>
<tr>
<td>Physical activity</td>
<td>Self-reported physical activity estimates, time spent for work and leisure</td>
</tr>
<tr>
<td>Dietary habits</td>
<td>A detailed module with a number of questions that enable the creation of the dietary profile; information on breakfast, fat, sugar and caffeine intake, salt, meat, fruit/vegetable consumption</td>
</tr>
<tr>
<td>Alcohol consumption</td>
<td>Questions on types and amount of alcohol consumption, binge drinking</td>
</tr>
<tr>
<td>Physical measurement</td>
<td>Height, weight and waist circumference, blood pressure and pulse rate</td>
</tr>
</tbody>
</table>
used in a pooled analysis with a number of other similar surveys that take place across Europe. A quick comparison to some of these surveys indicates that CAHS is somewhere between all these studies in terms of the sample definition and size, while it provides estimates that are methodologically comparable to some of the better surveys that were analyzed in that study. Additionally, it would be very interesting to perform representative survey of the Croatian island populations, which have been shown to have unusual prevalence of certain diseases and therefore present highly interesting research targets.

In conclusion, national surveillance studies are usually based on the cross-sectional design that is repeated in a periodic manner, but in different samples. Therefore, the future plan for the CAHS is to perform a new cross-sectional study ten years after the initial one, namely in 2013. This study would be similar to the 2003 study, aiming to provide another population-based representative sample that will be used to provide the population based risk factor prevalence estimates.

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REFERENCES


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