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Health-Risk Behaviour in Croatia

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Abstract. *Objective:* To identify the health-risk behaviour of various homogeneous clusters of individuals.

Study design: The study was conducted in thirteen out of twenty Croatian counties as well as in Zagreb, the Croatian capital. At a first stage, in every county, GP offices were selected. Then, a second-stage sample was created by drawing a random sub-sample of 10% of the patients registered in each selected GP office in the first-stage sample.

Methods: The obtained sample was divided into seven homogenous clusters by means of statistical methodology combining multiple factor analysis with a hybrid clustering method.

Results: Seven homogeneous clusters were identified, three composed of males and four of females, based on statistically significant differences between selected characteristics ($p<0.001$). Although in general, self-assessed health declines with age, we observed significant variations within specific age intervals. Self-assessed health strongly improved with a higher level of education and/or socio-economic position. People, and especially females who self-reported poor health, were heavy consumers of sleeping pills.

Males and females reported different health-risk behaviours, related to lifestyle, food choices and the use of healthcare. Heavier alcohol and tobacco use, carefree dietary behaviour, risky physical activity and the lack of regular utilization of the health care system impacted the males' self-assessed health. Females at the same age and educational level as males were slightly less satisfied with their health. Even highly-educated females, who followed preventive health care and testing, and kept a healthy diet, surprisingly reported a less satisfactory self-assessed health level than could have been expected.

Conclusion: Socio-demographic characteristics, lifestyle, reported self-assessed health, and the use of health care, allowed us to identify seven homogeneous population clusters. A comprehensive analysis of these clusters serves health-related prevention and intervention efforts geared towards specific populations.

Abstract word count: 296

Keywords: Health self-assessment survey; health-risk behaviours; free-text answers; multiple correspondence analysis; cluster analysis.

Introduction

Health improvement, the key objective of public health policy, first of all, requires solid factual information about the population's current health status.[1] Particularly interesting are health surveys conducted by means of the general population's health self-assessments and some other tools in periods of major transitions. They help us to define priority concerns and design the most effective health case systems. The project "Analysis of the Croatian Health Care System in Transition" (*Andrija Stampar* School of Public Health, School of Medicine, University of Zagreb) was focused on the post-war transitional period, and it comprised a major health survey. Preliminary results from specific parts of that survey have already been published[2-6]. In our work, we use the data collected by that survey in a way that allows us to identify particular health-risk behavioural patterns.

In public health surveys, several model-based research designs have been used, generally limited to selected features of the population. For example, the relationships between the following variables have been studied: self-assessed health and lifestyle[7]; self-assessed health and personality[8]; legal drug use, gender, morbidity, use of healthcare and lifestyle[9]; nutrition and socio-demographic characteristics[10,11]; risky lifestyle factors[12-14], the use of healthcare and lifestyle[15]; promotion of healthy lifestyle[16]; as well as isolated risky lifestyle such as smoking.[17,18]

However, in times of dramatic change, the previously obtained information is no longer valid[19] and questions concerning the health status of the population cannot be answered by the use of models constructed by using *a priori* selected criteria, such as previously chosen variables. It is necessary to go back to the individuals and their characteristics, that is, to introduce a multidimensional holistic approach that integrates a great number of variables. Thus, the most important variables can be detected and the examination of all cross-tables avoided. In our case, this approach appeared to be a powerful tool and helped us identify diverse health-risk behaviour patterns among homogeneous clusters of individuals.

Methods

Data

The data are derived from the Croatian health survey conducted in 1997/1998, i.e. two years after the end of the war, in order to estimate the health status of the population and evaluate the health system in transition.

The study was conducted in thirteen out of twenty Croatian counties (Zagreb,County, Split, Dubrovnik, Bjelovar, Osijek, Primorska, Zadar, Sibenik, Istria, Koprivnica, Lika, Pozega and Vukovar) as well as in Zagreb, the Croatian capital. At a first stage, in every county, 2 GPs were selected (in Zagreb County and Zagreb Capital, respectively, 3 and 7 GPs). The selection of the GPs suffered a selection bias, due to the substitution of the those reluctant to participate. Then, a second-stage sample was created by drawing a random sub-sample of 10% of the patients registered in each selected GP office.

Face-to-face interviews were conducted at the respondents' households by trained students from the School of Medicine. To reduce the non-responses, repeated visits were attempted. However, since the study was carried out two years after the war which affected half of the Croatian territory, the sampling and field strategies appeared not to work as expected. The statistical information was incomplete and the pollsters lacked the necessary experience. A total of 5048 respondents returned the questionnaire. Among them, there were 3065 females but only 1983 males. This shows an obvious imbalance between genders.

Only 8.7% explicit refusals were observed, varying from 3.4% to 14.4% among the counties. Referring to non-response rate, we only could evaluate it. Neither information about the replacements of GPs has been centralised, nor absentees were systematically recorded. First, we computed this evaluation from both the observed and total numbers of GPs (34 and 2400), the total population over 18 (4,437,000, inhabitants counted up in the 2001 census) and the sampling rate at the second stage. Secondly, we performed another evaluation from supposing homogeneous rates of refusals in males and females, a negligible proportion of absentees in females and taking into account the relative proportion of males and females in the population over 18. Both evaluations gave close results, respectively 20% and 22%. Recent studies conducted on the general population in Croatia have shown non-response rate close to 16%. In this latter case, they have carefully taken into account the out-of-cope units. In our case, we had no information and only knew that there were more deaths and moves in males than in females.

Moreover, neither the 1991 nor the 2001 censuses could be used as a frame of reference. Considerable and unpredictable demographic changes had taken place during and after the war. Furthermore, the study only concerns the individuals registered at GP offices in the thirteen mentioned counties at the time of the study. Thus, no reliable re-weighting of data was advisable

Thus, our study suffers obvious limitations. Means, proportions and the domain sizes estimations would be biased and no inference to the general population could be performed.

Nevertheless, the methodology that we use (described in the following section) is based on correlation structures. The identified patterns are much less dependent on the individual weight system than sample means or frequencies[20] (see p 182). As a check, a simulated weighting that balanced the numbers of males and females (weight 1 for females and 1.5 for males) has confirmed the stability of the patterns. Therefore, we can conclude that observed health-risk behaviours did actually take place in the population, although we could not calibrate the relative weights of the identified clusters. Other different patterns could exist, corresponding to subpopulations not observed or under-represented in the sample.

Despite the aforementioned shortcomings of the analysed data, they were a sufficient source of information about health-related problems in the time of a major societal transition.

The Questionnaire

The questionnaire addressed five areas. Four of them listed below, required answers to closed-ended questions. These were:

- Socio-demographic data: gender, age, education and economic status;
- Lifestyle: smoking and drinking habits, sport or physical activities;
- Self-assessed health by using the SF-36 questionnaire;
- Use of health care: visits to GP's, a specialist's office and preventive services.

The fifth area referred to food choices and offered the following open-ended question: "*What did you eat and drink yesterday (state all meals and beverages)*?" Every answer consisted of a complete list of items that were carefully copied (e.g. *bijela_kava, kruh, juha, riza, kuhano_meso, mlijek*o/ white coffee, bread, soup, rice, cooked meat, milk). This free-text recording of meals and beverages did not allow us to measure the individual diet intake, but it permitted for a comparison of food cultures[21,22], and that was one of our goals. This way of data collection was time-saving and worked well as part of a larger questionnaire. The absence of a provided list of meals and beverages played a positive role in establishing an atmosphere of confidence, and thus answers that could have been perceived as non-desirable were not concealed.[22] In fact, we were much more interested in responses provided by clusters of individuals than by particular individuals (who could vary any day) because we wanted to identify specific nutrition trends and their link to health-related problems. This particular question was very well received, it was found interesting and evoked consistent answers (only 2% refusal rate among the respondents; mean length of the answers was 8.5 words).

Statistical methods

Overall strategy

Our goal was to divide all individuals according to the characteristics obtained by the first four sets of close-ended questions. We used the principal axes method as a pre-processing step. [23] It allowed us to synthesize all the initial variables, gave us the principal coordinate vectors and helped us identify the clusters. Then, every cluster was described by the features that made it significantly different from the rest of the sample.

At first, we dealt with individuals who were simultaneously identified by categorical variables, as well as in a referential way, by means of multiple correspondence analysis (MCA).[23,24] However, since we wanted to balance the influence of the different areas (every area consisted of a set of variables), we used the extended form of MCA, based on multiple factorial analysis (MFA).[25,26] MFA standardizes the highest axial variance of each set to 1 by conveniently re-weighting every variable depending on the set to which it belongs. Thus, the first principal axis is not determined by the variables of only one area. So as in MCA, also in MFA the distance between two individuals decreases if the number of common characteristics increases. MFA offers a graphic representation of the inter-individual and the inter-categories distances; the interpretation rules are the same as in MCA. Responses of eleven individuals were eliminated from our analysis because they presented many missing values.

Next, the hybrid clustering method was used starting with the first and the most statistically significant principal coordinate vectors, while filtering the noise conveyed by the last ones.[20,25,27] First, a hierarchical clustering was performed using classic Euclidean distance and the Ward aggregation criterion.[25,27] Then, after cutting the tree, a sequence of *k*-means iterations were performed to consolidate the clusters.

Finally, the clusters were described by the significantly over and under represented characteristics of the gathered individuals.[27]

Even though the answers concerning food choices did not intervene in the clustering, they were included as supplementary information. Meals and beverages significantly over or under represented in each cluster were identified by means of a statistical criterion.[22]

Results

Main trends illustrated by maps

MFA allowed us to detect three axes that summarized the relationships between various areas. They retained only 15% of the total variance. However, in MCA the rates of variance corresponding to the first axes were necessarily low because of the codification.[25,27].

The shapes of the individual distribution (Figure 1) and the distribution by categories (Figures 2 and 3), suggested interpretation of the bisectors rather than the axes, which was in accordance with the close proportions of variance retained by the two first axes (6.94% versus 4.97%). The first bisector (Figure 2) revealed the difference between genders, mainly due to different lifestyles (See in Tables 1 and 2 the distributions of drinking and smoking habits by gender and age intervals). The second bisector (Figures 2 and 3) separated the categories characterized by very good or excellent health (and the absence of activity restrictions) from the categories with bad health (and many activity limitations). As expected, self-assessed health declined with age and improved with educational level. Since younger people were more educated, we had to inquire about the education effect on individuals of the same age. Figure 3 and Table 3 clearly showed that a lower level of education was linked to poor health in both genders. Self-rated income and socio-economic status, highly correlated to one another, had a similar effect: lower income and/or socio-economic status accounted for self-assessed poor health. This was the first finding related to health inequalities.

INSERT TABLES 1-3 HERE

INSERT FIGURE 2 HERE

INSERT FIGURE 3 HERE

Furthermore, we also observed that:

- there was a strong connection between various limitations in performing daily activities, suggesting that different aspects of health were closely related, and thus, any action undertaken to improve self-assessed health influenced all its dimensions;
- the mean of female self-assessed health was poorer than that of males, who selected the descriptive *"excellent*" much more often than females; categories reflecting positive health self-assessment were slightly closer to the male than female sub-cluster, while those with a negative health self-assessment were closer to the female sub-cluster;
- the total trajectory of age intervals showed a bigger gap between "46-55" and "56-65" age-intervals than between any other consecutive age intervals, which suggested that around the age of 55 there is a turning point for many aspects of self-assessed health;
- the relative positioning of "*PAP-yes*" and "*PAP-no*, on the one hand, and "*Mammogram-yes*" and "*Mammogram-no*" on the other, suggested a link between

higher education and higher income of younger females and their participation in preventive testing.

Cluster analysis

Starting with the coordinates of the individuals on the three first axes, we were able to identify seven clusters. The elevated value (78%) of the quotient between-clusters variance and total variance indicated strong internal homogeneity of the clusters.

INSERT TABLE 4 HERE

A detailed description of all clusters is presented in Table 4, by means of categories significantly over-represented as compared to the whole sample (P-value < 0.001). Referring to health status, we also calculated the mean within the cluster of the *General health* score (GH-score) derived from SF-36. Meals and beverages over-represented in every cluster compared to the whole sample were also reported ($p<0.05$), giving an insight about the different food cultures.

Figure 4 shows the centroid of every cluster on the first principal plane, providing information about the relative proximity of different clusters.

INSERT FIGURE 4 HERE

Discussion

This research suggests a number of possible directions for further studies.

Social inequality and health: Health is related to age but, for any given age, we found a large range of self-assessed health conditions, suggesting not only age related inequalities in health. Although the reasons were complex and intertwined, we were able to capture the significance of education, economic status and, to some extent, of gender.

Healthcare and preventive behaviour: As expected, females[29] participated in preventive healthcare more often than males. Seniors were expected to use such services even more often and to display preventive behaviours.[30] Males seemed to fulfil this expectation, but females did not. Only middle aged and highly educated females (cluster 6) participated in gynaecological preventive testing. Regarding other preventive checkups, females from cluster 6 revealed preventive behaviour as intensive as senior females from cluster 4, and even more intensive than that of the youngest females with average education, from cluster 7. In the case of females, preventive behaviour was linked to socioeconomic status and education, and this link was particularly strong in the case of preventive gynaecological tests.

Food choice: Young males adopted a modern eating pattern, including fast food and non-traditional products (sandwiches, French fries, pizzas, cola, whisky), while senior males followed the more traditional pattern, favouring meat and starchy meals[31,32]. Although all female clusters avoided heavy traditional meals such as bacon and pork fat, only clusters 6 (middle-aged females, higher education, intense use of preventive care) and 4 (senior females) seemed to follow a diet, the first of these two clusters to keep a balanced diet, and the second, for medical reasons.

Health and gender: Females, even the youngest ones, showed less satisfaction with their health status than males. The comparison between clusters 6 and 5 gave us some clues as to why that was the case. Figure 4 pointed out that Cluster 6 (middle-aged females, higher education, intense use of preventive care) was positioned close to cluster 5 (middle-aged and elderly females, little physical activity, lower education, very little use of healthcare and traditional lifestyle and food choices). Thus, the females in cluster 6 showed a lower self-assessed health status than it could have been predicted on the basis of age and education. The following hypothesis could be formulated: females were disturbed by the changes in society, they had to develop strategies to manage work-family conflict, and they paid the high cost of adaptation. Our results differed from those obtained in Canada[33], but they were similar to the findings from Spain[28], a country where females are experiencing a dramatic change in lifestyle. Besides, the comparison between clusters 2 and 5 (middle-aged males and females) led to the conclusion that males and females had different attitudes to health, rather than significantly different health statuses.

Conclusion

In conclusion, our results provided a comprehensive picture of the different health related behaviour patterns and the concomitant variables. They constitute a starting point for further studies of more specific problems related to health inequalities in Croatia. Such studies could address, on the one hand, significant implications for health-related issues of dramatic socio-economic changes, particularly impacting females and, on the other, the development of new methodologies incorporating, for example, the techniques to collect information about food choices.

Software note

The results have been obtained by using SPAD software (http://www.decisia.fr).

Acknowledgments

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Figure captions

Figure 1. Projection of the individual cloud on the first principal plane; the centroids of the male and female subclouds are also represented.

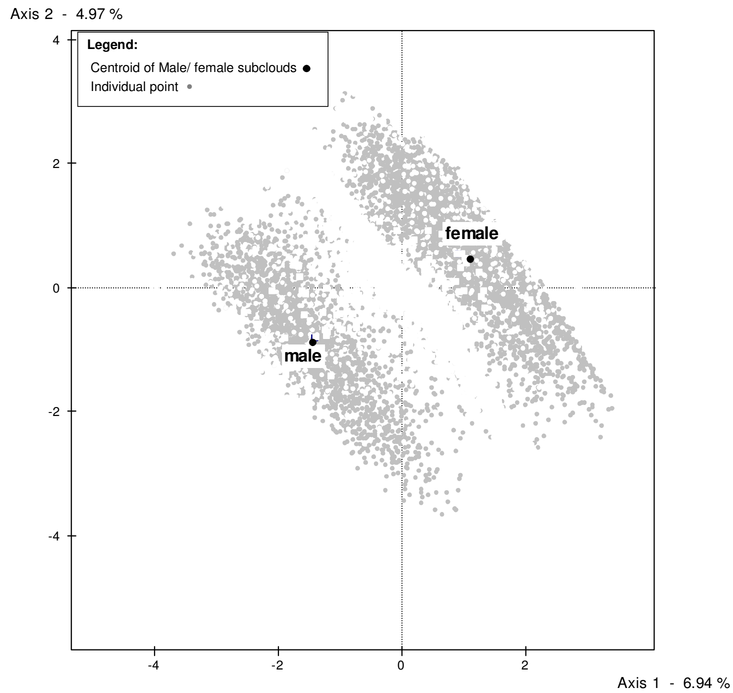


Figure 2. Strong connections between different aspects of health, shown on the first principal plane. The first bisector separates male and female behaviour. The second bisector shows how age accounts for differences in health self-assessment.

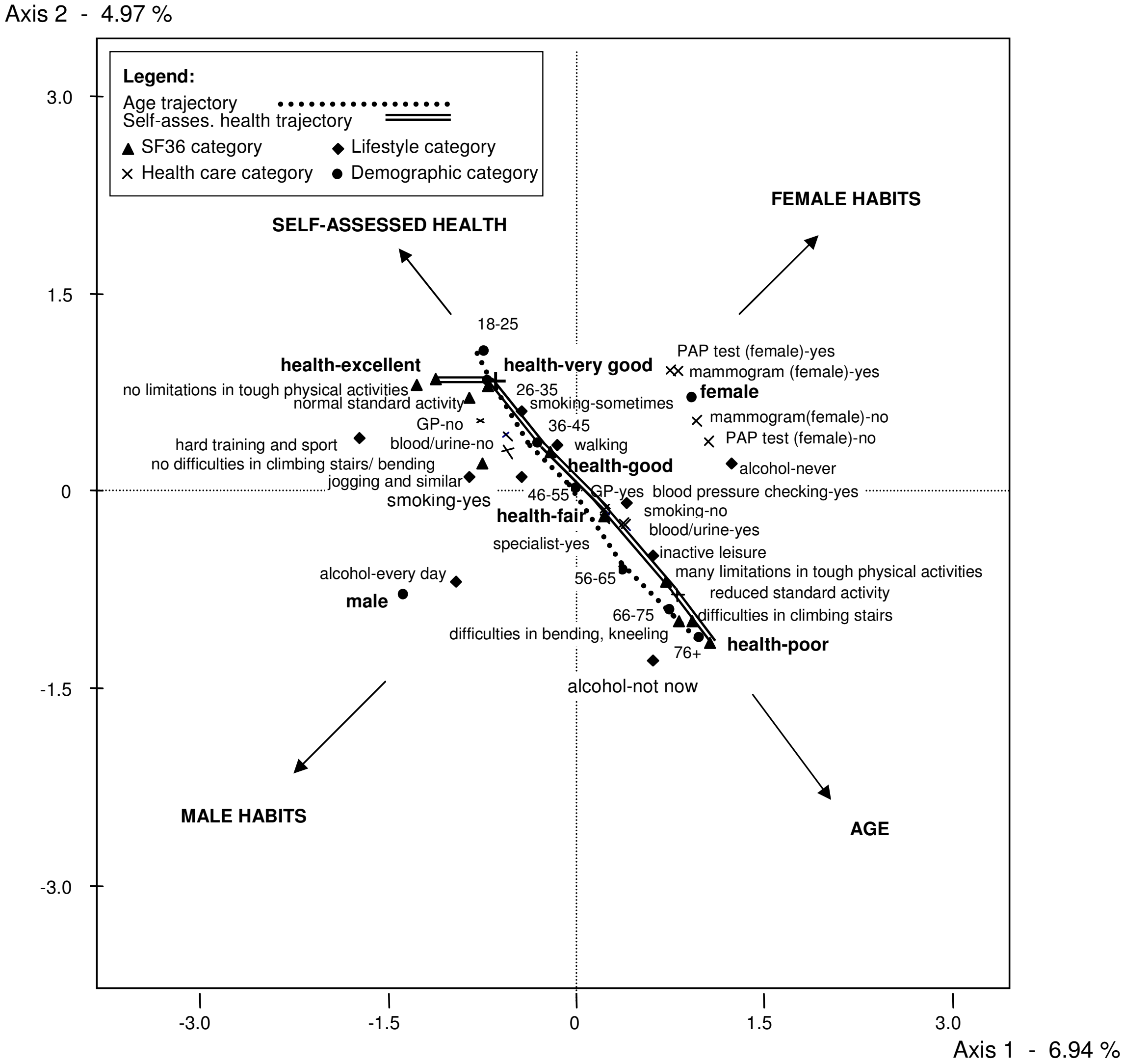


Figure 3. The influence of education and gender. The trajectories of age by gender and education (primary school and high school/university) are compared to the trajectories of age by self-assessed-health (poor and excellent).

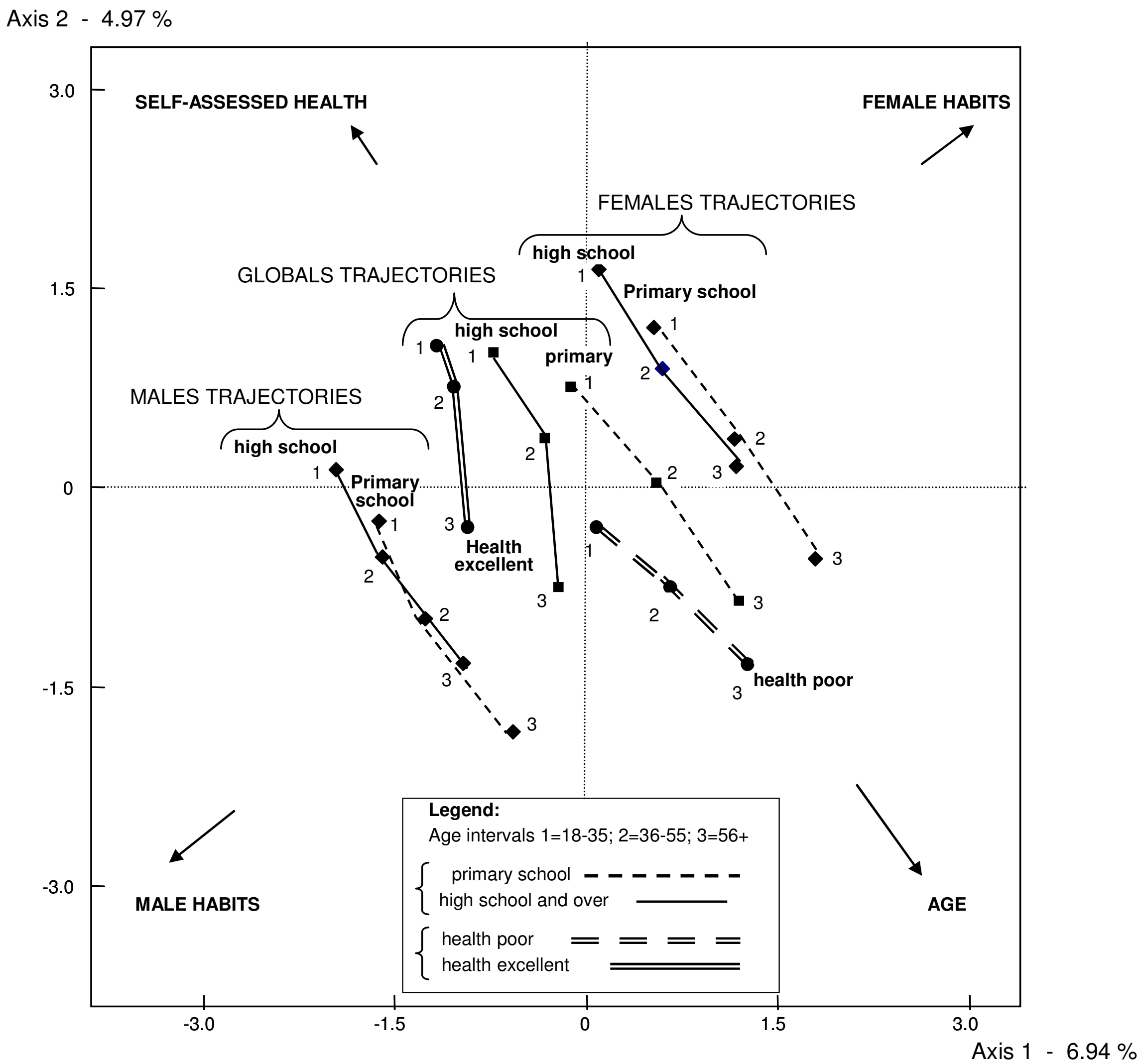
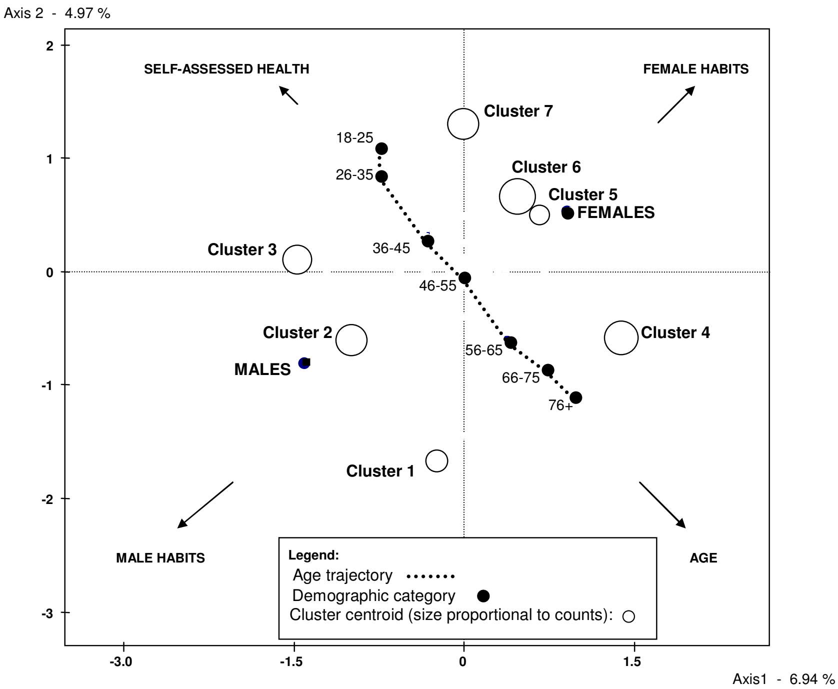


Figure 4. Projection of cluster centroids on the first principal plane derived from MFA



		Education						
Gender	**Age**	**No school**	**Primary school**	**Training college**	**Secondary school**	**High school**	**University**	**Total**
Males	18-35	9	49	72	369	28	77	604
		4.00	3.59	3.71	3.65	3.29	3.81	3.7
	36-55	13	72	126	237	62	87	597
		2.46	2.42	2.66	2.77	2.98	3.33	2.8
	56 and over	123	154	197	168	56	81	779
		1.89	1.99	2.21	2.17	2.57	2.36	2.1
Females	18-35	14	119	55	528	42	110	868
		3.86	3.31	3.47	3.46	3.62	3.33	3.5
	36-55	48	213	67	411	98	126	963
		2.00	2.31	2.54	2.66	2.99	3.06	2.6
	56 and over	424	400	95	217	48	42	1226
		1.72	1.92	2.03	2.13	2.17	2.4	1.9
Total	Total	631	1007	612	1930	334	523	5037
		1.9	2.3	2.6	3.0	2.9	3.2	2.7

Table 1. Self-assessed health by age, gender and education.

In every cell, the number of individuals and the mean value of self-assessed health (varying from 1= poor to 5=excellent).

		Drinking habits				
Gender	**Age**	**No drinker**	**Occasional drinker**	**Usual drinker**	**Missing data**	**Total**
Males	18-35	68 (11.3%)	272 (45.0%)	260 (43.0%)	4 (0.7%)	604 (100%)
	36-55	89 (14.9%)	206 (34.5%)	301 (50.4%)	1 (0.2%)	597 (100%)
	56 and over	151 (19.4%)	207 (26.6%)	417 (53.5%)	4 (0.5%)	779 (100%)
Females	18-35	221 (25.5%)	555 (63.9%)	87 (10.0%)	5 (0.6%)	868 (100%)
	36-55	304 (31.6%)	511 (53.1%)	142 (14.7%)	6 (0.6%)	963 (100%)
	56 and over	557 (45.4%)	450 (36.7%)	212 (17.3%)	7 (0.6%)	1226 (100%)
Total	Total	1390 (27.6%)	2201 (43.7%)	1419 (28.2%)	27 (0.5%)	5037 (100%)

Table 2. Distribution of drinking habits by age and gender.

In every cell, numbers and percentages of individuals.

		Smoking habits				
Gender	**Age**	**No smoker**	**Occasional smoker**	**Usual Smoker**	**Missing Data**	**Total**
Males	18-35	260 (43.1%)	80 (13.3%)	262 (43.4%)	2 (0.3%)	604 (100%)
	36-55	255 (42.7%)	59 (9.9%)	283 (47.4%)	0 (0.0%)	597 (100%)
	56 and over	158 (20.3%)	38 (4.9%)	582 (74.7%)	1 0. (1%)	779 (100%)
Females	18-35	270 (31.1%)	134 (15.4%)	464 (53.5%)	0 (0.0%)	868 (100%)
	36-55	279 (29.0%)	72 (7.5%)	609 (63.2%)	3 (0.3%)	963 (100%)
	56 and over	94 (7.7%)	38 (3.1%)	1088 (88.7%)	12 (0.5%)	1226 (100%)
Total	Total	1316 (26.1%)	421 (8.4%)	3288 (65.3%)	12 (0.2%)	5037 (100%)

Table 3. Distribution of smoking habits by age and gender.

In every cell, numbers and percentages of individuals.

Cluster 1. (n=549) Male: (96%;39%) Average age: 65.1 Economic status: below average (56%; 38%) Education: low/middle (69%; 47%) Self-assessed health: poor/fair (86%; 47%) Use of health care: GP & specialist: (92%; 78%)& (70%; 50%), BP measurement (93%; 76%); Drugs: for heart (56%; 29%), sleeping pills (34%; 22%) Lifestyle: drinkers/former drinkers: wine (68%; 36%); Former smokers: (52%; 32%); Physically non active: (62%; 45%). Average GH-score (SF-36): 32.6 Meals and beverages: polenta, pork, soup, bread, pepper, lard, onion, cracker, broad bean, bacon, roasted beef, green beans, pudding, cabbage/ wine, tea, raki	**Cluster 2. (n=780)** Male: (96%; 39%) Average age: 47.0 Economic status: average (55%; 49%) Education: middle/ high (89%; 67%) Self-assessed health: good/fair (69%; 53%) Use of health care: GP & specialist: (92%; 78%) & (60%; 50%); BP measurement (87%; 76%) Lifestyle: drinkers/former drinkers: wine (76%;36%); Smoker/former smokers: (92%;58%); walking/running (58%;48%). Average GH-score (SF-36): 57.7 Meals and beverages: French fries, goulash, fish, lard, tripe, white beans, cheese, meat, cold roasted meats/ wine, beer, salami, raki,
Cluster 3. (n=700) Male: (98%;39%) Average age: 37.5 Economic status: higher than average (22%; 12%)	**Cluster 4. (n=864)** Female: (99.7%; 61%) Average age: 66.4 Economic status: low (58%; 38%)

Education: middle (65%; 50%) Self-assessed health: excellent/very good (59%; 28%) Use of health care: non-users of GP & specialist: (60%; 20%) & (85%; 50%); non-BP measurement: (54%; 21%) Lifestyle: drinkers: beer (54%; 28%); Smokers/former smokers: (79%; 58%); training sport/running (46%; 21%). Average GH-score (SF-36): 73.3 Meals and beverages: raw ham, lard, mayonnaise, ham, salami, sandwich, pizza, salad, French fries, chocolate, artichoke, cheeseburger, bologna, cocoa, egg, fish, cucumber /beer, wine, coke, other alcoholic drinks, raki	Education: low (75%; 33%) Self-assessed health: poor (59%; 21%) Use of health care: GP & specialist: (96; 78 & 69; 50); BP measurement (97%; 76%), no PAP test (72%; 34%), no mammogram (75%; 42%) Drugs: for heart (66%; 29%), sleeping pills (45%; 22%) Lifestyle: Non drinkers: (59%; 20%); Non smokers: (92%; 65%); Physically non active: (75%; 45%) (75%; 42%). Average GH-score (SF-36): 32.5 Meals and beverages: soup, chicken, bread, yoghurt, polenta, flour products, beetroot, semolina, cabbage, white beans, orange, compote/ milk, tea, coffee, water
Cluster 5. (n=478) Female: (98.5%; 61%) Average age: 56.8 Economic status: lower than average (24%; 38%) Education: low (70%; 33%) Self-assessed health: good/fair (70%; 53%)	**Cluster 6. (n=890)** Female: (99.7%; 61%) Average age: 42.8 Economic status: average (56%; 49%) Education: middle/high (77%; 55%) Self-assessed health: good/fair (67%; 53%) Use of health care: Users of GP &

Use of health care: Non-users of GP & specialist: (43%; 78%)& (83%; 44%); no BP measurement (41%; 21%), no PAP test (94%; 34%), no mammogram (96%; 42%) Lifestyle: Non drinkers: (43%; 20%); Non smokers: (92%; 65%); Physically non active: (48%; 45%) Average GH-score (SF-36): 56.3 Meals and beverages: corn salad, puff pastry, white beans, plum jam, bacon, bread /coffee, water, milk, raki	specialist (94%; 78%) & (80%; 50%); BP measurement (89%; 76%), PAP test (77%; 22%), mammogram (51%; 13%) Lifestyle: occasional drinkers: wine (63%; 43%); Smokers: (32%; 26%); Physical activity: walking (42%; 31%) Average GH-score (SF-36): 55.9 Meals and beverages: banana, fruit, kiwi, cake, buns, yogurt, pear, apple, tomato, beetroot, mashed potatoes, gnocchi, butter, orange /fruit juice, coffee
Cluster 7. (n=776) Female: (99.7%, 61%)	
Average age: 33.5 years Economic status: average (60%; 49%) Education: middle (62%; 38%) Self-assessed health: excellent/very good/good (83%; 53%) Use of health care: Non-users of GP & specialist: (32%; 78%) & (60%; 44%); no BP measurement (56%; 38%), PAP test (35%; 22%), no mammogram (79%; 42%)	Lifestyle: occasional drinkers: (42%; 25%); Smokers: (33%; 26%); walking (43%; 31%) Average GH-score (SF-36): 70.2 Meals and beverages: chocolate, cornflakes, ice-cream, buns, yoghurt, sandwich, French fries, candies, banana, doughnut, pizza, Frankfurt sausages, apple, cheeseburger, cakes, sauce, pancakes, carrot, dairy product, spread, courgette, mandarine /fruit juice, coke, instant coffee.

Table 4. Description of the clusters.

For every selected characteristic the occurrence is significantly higher in any given cluster than in the whole sample (p-value <0.001). In parentheses, percentages of individuals carrying those characteristics within a given cluster and in the whole sample.

Listed meals/ beverages have been cited significantly more often in a given cluster than in the whole sample (p-value <0.05). Meals/beverages were ranked depending on the associated p-value.

Age and GH score (SF36) are presented in mean values.