*ORIGINAL ARTICLE*

Annals of Agricultural and Environmental Medicine 2011, Vol 18, No 2, 221-228
www.aaem.pl

# Alcohol drinking patterns and habits among a sample of PONS study subjects: preliminary assessment

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## Abstract

**Introduction:** Alcohol drinking is a major contributing factor to death, disease, injury and social problems such as violence or child neglect and abuse, especially in Eastern Europe.

**Objectives:** To preliminary evaluate the prevalence and social and behavioural patterns of alcohol drinking in a pilot group of the Polish-Norwegian Study (PONS study) subjects.

**Material and methods:** Open-ended prospective cohort study conducted in Świetokrzyskie province. A pilot group of subjects aged 45-64 years has been examined. Data on alcohol drinking were collected for 3,845 respondents with the use of the Health State Questionnaire administered by the CAPI method.

**Results:** In males, 72.3% drank alcohol currently, 22.7% were former drinkers, and only 5% never drinkers. Among females, the percentage of current alcohol drinkers was significantly lower than in males, while the percentages of former and never drinkers was higher (50.3%, 35.4% and 14.6%, respectively). 7.4% of males and 0.8% of females drank alcohol daily or almost daily, and weekly alcohol drinking was respectively at level of 32.2% and 15.7%. Males drank mainly vodka (or other spirits) and beer, females grape wine and vodka.

**Conclusions:** PONS study includes interesting dataset for assessing prevalence and patterns of alcohol drinking at population level. Alcohol drinking seems to be common among PONS subjects. Comparison with nation-wide surveys shows on higher number of alcohol abstainers and lower number of binge drinkers among PONS study subjects. On the other hand, frequency and social patterns of alcohol drinking seem to be consistent with data found in national studies.

## Keywords

Alcohol drinking, adult Poles, cohort study

## INTRODUCTION

Alcohol drinking is a major contributing factor to death, disease, injury and social problems such as violence or child neglect and abuse. Clinical and epidemiological studies prove that 60 types of diseases and injuries are caused by alcohol and 200 diseases are alcohol-related [1]. World Health Organization (WHO) report evaluates that almost 4% of all deaths worldwide are attributed to alcohol, which exceeds the number of deaths caused by HIV/AIDS, violence or tuberculosis [1]. Every year, around 2.5 million people die from hazardous and harmful use of alcohol, including 233,000 deaths from cancer [1,2]. Alcohol drinking is also one of the crucial contributors to the liver cirrhosis epidemic in the world and its patterns can modify the risk of coronary heart disease [3,4].

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Received: 15 October 2011; accepted: 3 December 2011

In the European Union, 58 million adults are heavy alcohol drinkers and 80 million characterize a binge-drinking pattern (drinking more than five drinks on one occasion) [5]. Symptoms of alcohol abuse occur among 23 million alcohol drinkers in EU countries. Europe belongs to the regions of the world with the highest level of alcohol consumption and rates of alcohol-attributable harm. In 2005, the total adult per capita consumption of pure alcohol in the WHO European region exceeded 12 liters, this being almost two times higher than the worldwide average [1]. In the European Union, alcohol drinking is one of the most important lifestyle risk factors and health contributors, especially in male population [6-8]. In 2002, 13.5% of deaths (16.4% in males and 7.2% in females) in the age group 20-64 years in the EU25 (15 European Union members and 10 candidate countries) were attributed to alcohol [6]. The European Code Against Cancer recommends limiting and controlling alcohol consumption in order to prevent cancer risk [9].

However, the highest level of alcohol drinking and alcohol attributed death rates occur in the eastern part of Europe, mainly in the former Soviet block countries [2,10-14]. It is estimated that the high consumption of alcohol in this region is responsible for approximately 90 extra deaths in males and

60 deaths in females per 100,000 inhabitants in the new EU Member States, compared with the older 15 EU countries [5]. In 2002, the highest alcohol-attributable mortality occurred in Estonian males (259/100,000 person-years) and Hungarian females (52/100,000 person-years) where the death rates were, respectively, 11 and 15 times higher than in EU countries with the lowest premature mortality caused by alcohol [6].

In Poland, the total consumption of alcohol in the adult population was at that time at the level of 8 liters a year per person [5]. High and frequent consumption of alcohol among 20-64 year-old Polish males contributed to a lower life expectancy at birth in this group, compared with the same age group of males living in the EU15. The contribution of alcohol-attributable mortality in this difference was estimated in 2002 on 14% [6].

This paper presents preliminary data on alcohol drinking behaviours, its social and behavioural patterns and amount of alcohol consumed in a sample of PONS study subjects, a cohort of middle-aged adults living in poorer part of Poland.

## MATERIAL AND METHODS

### The aim of PONS study

The PONS study (Polish-Norwegian Study of Chronic Diseases) is an open-ended prospective cohort study aimed at evaluating the impact of biological and lifestyle risk and protective factors on the health status of the Polish population, especially on the incidence of chronic diseases and quality of life. A detailed description of the study objectives, design and its execution is included in another paper published in this issue of the journal [15].

### Sample and data collection

The study is set in the south-eastern part of Poland, in the Kielce region of Swietokrzyskie province. In its first phase conducted between September 2010 and December 2011, subjects' recruitment and data collection is planned to be carried out among 15,000 adults aged 45-64 years who are permanent residents of two distinct geographical areas of the Kielce region: 1) the city of Kielce (with 60,000 inhabitants at the above age) and neighbouring rural district (Kielce county, with 50,000 inhabitants of the same age). Finally, 100,000 inhabitants of Kielce region will be invited to participate in the PONS study. It is also planned to conduct at 5-year intervals follow-up studies on representative samples of at least a few thousand surviving subjects. The recruitment of PONS study subjects is conducted through a media campaign, newspaper advertisement, and broad distribution of leaflets.

Study participants were invited to respond to the Health State Questionnaire, undergo a medical check-up, including a number of clinical and anthropometric measurements (such as height, weight, hip fractures, waist circumference, blood pressure), and to provide a blood and urine sample for assessing lipid and glucose profiles. All biological samples were collected for long-term storage and check in the laboratory.

The Health State Questionnaire was a systematic and structured computer-assisted personal interview (CAPI) administered by trained nurses and completed within around 40 minutes. The questionnaire included data on respondent's health status (including medical history and health self-esteem), demographic and social features (i.e. gender, age, marital status, place of residence, education, personal and household income, employment and occupational status), psychological status (i.e. depressive symptoms and episodes), and selected lifestyle health behaviours (including active and passive tobacco smoking, alcohol drinking, diet habits, obesity indicators, physical activity). Respondent's answers were sent directly to a data server for further processing and management.

All information collected within the PONS study was confidential and analyzed and published for scientific purposes. The study design was approved by the Ethics Committee of the Maria Skłodowska-Curie Cancer Center and Institute of Oncology in Warsaw, Poland.

### Measurement

The PONS study provides information on subjects' alcohol drinking behaviours, consumption, and its social and behavioural patterns. The questions asked about alcohol drinking have been adapted from standardized nation-wide surveys conducted in adult Polish and European populations [16,17].

Alcohol drinking behaviours were measured by assessing the prevalence of ever, current, former, and never alcohol drinking. Ever alcohol drinkers included subjects who drank alcohol currently or in the past. Current alcohol drinkers were defined as those respondents who answered 'Yes' to the question 'Did you try to drink alcoholic products in the past 30 days?' while to former alcohol drinkers belonged those subjects who answered negatively on the above question, but positively to the question 'Did you consume alcohol products in the past?' Former alcohol drinkers were asked at what age they quit alcohol drinking. Never smokers included those PONS respondents who underlined the answer 'No' to both questions.

Frequency of alcohol drinking was analyzed in three categories: 1) daily or almost daily alcohol drinkers, 2) those subjects who were drinking alcohol a few times a week, and 3) those who were drinking a few times a month or less often. Daily or almost daily alcohol drinkers included subjects who drank any alcoholic product in the past 30 days on a daily basis, or at least 4-5 times a week. Weekly alcohol drinking was defined as the drinking of any alcohol product at least once a week, but not more often than 2-3 times a week. Finally, the category of very occasional alcohol drinkers included those PONS study subjects who drank alcohol last month only 2-3 times or less.

Data on the type and volume of alcohol consumed were based on questions about the drinking of particular alcoholic products within a usual occasion. Four basic types of alcoholic products were taken into consideration: consumption of beer, wine from grapes, wine from other fruits, and vodka or other spirits.

To calculate an annual amount of alcohol consumed per drinking person in litres, data on a standardized portion of an alcoholic drink (500 ml for beer, 125 ml for a glass of wine and 750 ml for a bottle of wine, and 50 ml for a glass of vodka or other spirit), were multiplied by the frequency of alcohol drinking in the past 12 months.

Alcohol drinking behaviours of the PONS study subjects were also characterized by binge drinking patterns and alcohol drinking before 12 am. Binge drinking was defined as drinking more than 5 standard portions of any alcohol product per one occasion in the past 12 months.

## Aim and design of analysis

The main goal of current analysis is the preliminary evaluation of the prevalence, socio-demographic patterns, and behavioural characteristics of alcohol drinking in a pilot group of respondents participating in the PONS study. Moreover, basic methodological problems concerned alcohol drinking by the study subjects have been investigated and discussed. For these reasons, the PONS study results were compared with available data on alcohol drinking from nation-wide surveys conducted in adult Polish population.

Current analysis of alcohol drinking is based on the results of the Health State Questionnaire among the first group of PONS study subjects, in total 3,845 respondents. Descriptive analysis includes the following basic alcohol-related variables: 1) prevalence of alcohol drinking behaviours, such as ever, current, former, and never alcohol drinking, and 2) characteristics of alcohol drinking habits, including frequency of alcohol drinking among currently drinking respondents, type of alcoholic product drunk in the past 12 months, annual amount of alcohol consumed per drinking person, binge drinking habit, and drinking alcohol before 12 am.

Using cross-sectional analysis, all the above variables have been related to respondents' demographic and socioeconomic status. Distribution of alcohol drinking behaviours, frequency of drinking, and type of alcohol consumed were calculated for all subjects and by gender, age and place of residence. Distribution of alcohol drinking by age was analyzed in two 10-year age clusters: 45-54 and 55-64 years. Place of residence was divided into two categories: urban and rural. Finally, it was decided not to include into current analysis data on respondent's level of education and income as data on alcohol drinking patterns, frequency, and consumed volume of alcohol by education and income were not consistent with other datasets and strongly interfered with the socio-demographic characteristics of the PONS sample.

The annual amount of alcohol consumed per drinking person was calculated in litres and analyzed for all male and female PONS study subjects. The same distributions have been made for the distribution of binge drinking habit and alcohol drinking before 12 am. Frequency of binge drinking was analyzed in 3 categories: once a week, once a month, and less than once a month. Since questions on binge drinking and drinking alcohol before 12 am could be sensitive for respondents and some would not answer, 'Do not know' and 'Refusal' categories were taken into consideration.

## Statistical analysis

Significant differences in the distribution of categorical variables (such as prevalence of alcohol drinking by type of alcohol or social strata) have been tested by chi-square test statistics, while differences in continuous variables (such as amount of alcohol consumed per person per occasion, or on an annual basis) have been analyzed by Kruskal-Wallis test. All statistical calculations have been made using Statistica PL software version 8.0.

# RESULTS

## Distribution of alcohol drinking behaviours

Table 1 shows the magnitude of alcohol drinking and distribution of alcohol drinking behaviours among subjects of the PONS study. Most of them have ever drunk alcohol (88.6%). Only 11.4% were never drinkers. Prevalence of current alcohol drinking was at the level of 57.7%. Almost one in three PONS study subjects (30.9%) was able to abstain from alcohol.

**Table 1.** Alcohol drinking behaviors among PONS subjects by selected socio-demographic strata

| Socio-demographic strata | Current drinking | | Former drinking | | Never drinking | | Ever drinking | | Chi-square statistics for distribution of current, former and never drinking | Chi-square statistics for distribution of never vs. ever drinking |
|---|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | | |
| **All subjects** | | | | | | | | | | |
| Total (aged 45-64) | 2217 | 57.66 | 1189 | 30.92 | 439 | 11.42 | 3406 | 88.58 | Not applicable | Not applicable |
| Gender | | | | | | | | | | |
| Males | 929 | 72.30 | 292 | 22.70 | 64 | 4.98 | 1221 | 95.00 | $Chi^2$=185.451 | $Ch^2i$=78.114 |
| Females | 1288 | 50.30 | 897 | 35.00 | 375 | 14.65 | 2185 | 85.35 | p=0.001 * | p=0.001* |
| **Males** | | | | | | | | | | |
| Age | | | | | | | | | | |
| 45-54 years | 382 | 73.70 | 114 | 22.20 | 22 | 4.20 | 496 | 95.90 | $Ch^2i$=1.409 | $Chi^2$=0.744 |
| 55-64 years | 547 | 71.30 | 178 | 23.20 | 42 | 5.50 | 725 | 94.50 | p=0.7035 | p=0.3884 |
| Residence | | | | | | | | | | |
| Rural | 281 | 71.31 | 97 | 24.62 | 16 | 4.06 | 378 | 95.93 | $Chi^2$=4.461 | $Ch^2i$=1.700 |
| Urban | 648 | 72.73 | 195 | 21.89 | 48 | 5.39 | 743 | 94.62 | p=0.2158 | p=1923 |
| **Females** | | | | | | | | | | |
| Age | | | | | | | | | | |
| 45-54 years | 608 | 57.50 | 323 | 30.50 | 127 | 12.00 | 931 | 88.00 | $Chi^2$=37.316 | $Chi^2$=9.053 |
| 55-64 years | 680 | 45.20 | 574 | 38.20 | 245 | 16.50 | 1254 | 83.40 | p=0.001 * | p=0.0026 * |
| Residence | | | | | | | | | | |
| Rural | 387 | 49.43 | 305 | 38.95 | 91 | 11.62 | 692 | 88.38 | $Ch^2i$=12.699 | $Ch^2i$=7.919 |
| Urban | 901 | 50.70 | 592 | 33.31 | 284 | 15.98 | 1493 | 84.01 | p=0.0053 * | p=0.0049 * |

* Differences statistically significant; Chi-square statistics for distribution of current, former and never drinking among males versus females for:
age 45-54 years: Chi-square=46.49, p=0.0001 *, age 55-64 years: Chi-square=146.26, p=0.0001 *
rural residence: Chi-square=54.56, p=0.0001 *, urban residence: Chi-square=129.55, p=0.0001 *

## Socio-demographic patterns of alcohol drinking behaviors

Table 1 also includes data on alcohol drinking behaviours by gender, age and place of residence. Percentages of current, former and never alcohol drinkers, as well as percentages of ever and never alcohol drinkers, add up to 100%.

Primary results of the PONS study showed that in the male population, 72.3% drank alcohol currently, 22.7% were former drinkers, and only 5% never drinkers. Almost all the males (95%) drank alcohol in their lifetime. Among females, the percentage of ever and current alcohol drinkers was significantly lower than in males, while the percentages of former and never drinkers were higher (85.3%, 50.3%, 35.4% and 14.6%, respectively).

The distribution of alcohol behaviours did not differ in the age groups of males, while slight age differences were found in females. The younger group of females (aged 45-54) was characterized by a higher percentage of ever (88%) and current alcohol drinking (57.5%) and lower percentage of former (30.5%) and never alcohol drinking (12%) as compared with older (aged 55-64) females participating in the PONS study (respective percentages were 83.4%, 45.2%, 38.2% and 16.5%).

It is also worth indicating that the differences between males and females in the distribution of current, former and never drinking by age categories were statistically significant (see results of chi-square statistics at the bottom of Table 1).

Slight differences in alcohol drinking behaviours were seen among females when these data were distributed by place of residence of the PONS study subjects, especially among females who ever drank alcohol (88.4% in the rural area, 84% in the urban area), never drinking females (11.6% and 16%, respectively), and those females who abstained from alcohol drinking (39% and 33.3%).

Similar to comparisons of age categories, the differences between males and females in the distribution of current, former, and never drinking by place of residence were at a high statistically significant level (see results of chi-square statistics at bottom of Table 1).

## Frequency of current alcohol drinking

Table 2 includes data on the frequency of alcohol drinking among currently drinking PONS respondents by gender, age and place of residence.

These data show that the majority of respondents declared drinking alcohol a few times a month or less often (73.8%). However, a group of subjects who drank alcohol a few times a week (even 3 times) also seems to be large (22.6%). Only 3.6% of the PONS study subjects admitted to drinking alcohol daily or almost daily.

Gender differences in frequency of alcohol drinking were big and statistically significant ($p<0.001$). Males declared to drink alcohol at daily basis almost 9 times more often (7.4%) than females (0.85%). Percentage of males who drank alcohol few times a week was over two times higher (32.2%) as compared with females (15.7%). Among females higher was percentage of those currently alcohol drinkers who drank alcohol few times a month or less often (83.5% in comparison with 60.4% among currently drinking males).

Differences in frequency of alcohol drinking by age or place of residence were not so big as those observed in gender groups but statistically significant. PONS subjects were characterized by slightly higher percentage of weekly alcohol drinkers among younger (45-54 years old) than older (aged 55-64) persons (25.25% vs. 20.3%). On the other side, older respondents more often (75.7%) than younger (71.4%) drank alcohol few times a month or even less.

**Table 2.** Frequency of alcohol drinking among currently drinking PONS subjects by selected socio-demographic strata

| Socio-demographic strata | Drinking daily or almost daily | | Drinking few times a week | | Drinking few times a month or less often | | Chi-square statistics |
|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | |
| All subjects (aged 45-64) | 80 | 3.61 | 501 | 22.60 | 1636 | 73.79 | Not applicable |
| Gender | | | | | | | |
| Male | 69 | 7.43 | 299 | 32.19 | 561 | 60.39 | $Chi^2$=168.608 |
| Female | 11 | 0.85 | 202 | 15.68 | 1075 | 83.46 | p=0.000 * |
| Age | | | | | | | |
| 45-54 years | 31 | 3.10 | 252 | 25.50 | 707 | 71.4 | $Chi^2$=8.959 |
| 55-64 years | 49 | 4.00 | 249 | 20.30 | 929 | 75.7 | p=0.011* |
| Residence | | | | | | | |
| Rural | 18 | 2.69 | 132 | 19.76 | 518 | 77.54 | $Chi^2$=7.443 |
| Urban | 62 | 4.00 | 369 | 23.82 | 1118 | 72.18 | p=0.024* |

* Differences statistically significant

The PONS study indicates on statistically significant differences in frequency of alcohol drinking between subjects who were living in rural and urban areas. In general, respondents from urban area (Kielce town) more often drank alcohol than those living in surrounding rural area. Percentage of daily or almost daily alcohol drinkers among Kielce inhabitants was 1.5 times higher (4%) as compared with subjects living in rural area (2.7%). Also percentage of PONS subjects who were drinking alcohol at weekly basis was higher among inhabitants of Kielce town (23.8%) than those living in villages (19.8%). Slightly higher proportion of respondents who drank alcohol rarely (few times a month or less often) was noticed in rural (77.5%) than urban area (72.2%) of PONS study project.

## Type of alcohol consumed

Table 3 shows data on prevalence of alcohol drinking by type of alcohol consumed and selected socio-demographic strata, including gender, age and place of residence. These data have been calculated for those PONS study subjects who have drunk any alcohol product in the last year and present a proportion of drinkers of specific alcohol product in all study participants. As each respondent could drink few different types of alcohol, percentages presented in this table do not sum up to 100%.

The most often consumed alcohol product by the study participants was vodka or other high concentrated spirits. This kind of alcohol is drunk by 75.4% of subjects. High percent of respondents was also drinking wine produced from grapes (61.5%) and one of two (54%) beer. Percent of the study respondents who drank wine from other fruits was low (8.5%).

Type of alcohol consumed by PONS study subjects depended on gender. Gender differences were statistically significant. Among males dominated vodka (87.1%) and beer (77.3%) consumption. Many males also drank grape wine (46.7%). Among females mostly consumed alcohol products were grape wine (69.7%) and vodka or other spirits (68.7%). Grape wine was the only alcohol product that was more

often consumed by females than males. Moreover, percent of PONS study subjects who drank vodka and beer (41.0%) was much lower in females than males. In both gender groups, prevalence of wine produced from other fruits was at the same level (8.3% in males, 8.6% in females), the lowest as compared with other alcohol products consumed.

Age was not so strong predictor for type of alcohol consumed by participants of PONS study as gender was. In male population the only age difference that was statistically significant (p<0,03) was found for beer drinking. Beer was more often drinking by younger (at age of 45-54 years) than older males (55-64 years old) (80.7% vs. 75.0%). Among females strong statistically significant age differences were observed in beer (p<0.001) and vodka drinkers (p<0.02). Younger females drank both beer (46.1%) and vodka (71.7%) more often than older females (37.0% and 66.5%, respectively).

PONS study results showed bigger differences in drinking of various types of alcohol among inhabitants of urban and rural areas of the study. Both among males and females much higher percentage of grape wine drinkers was noticed in urban area, Kielce town (51.6% in males, 73.1% in females) than in the rural study area (36.1% and 62.3%). The difference was statistically significant at high level (p<0.001 for males and females). In contrast, PONS study subjects from Kielce town less often drank vodka or other spirits (males in 85.0%, females in 66.1%) than respondents living in villages (91.8% and 74.5%, respectively). In females statistically significant differences between urban and rural areas were also found among persons drinking beer (35.2% in rural area, 43.7% in urban area) and especially big among drinkers of wine from other fruits (14.1% vs. 6.1%).

As it is shown in chi-square statistics added to Table 3, gender differences between males and females drinking beer, grape wine and vodka or other spirits were statistically significant in age groups and place of living categories.

## Amount of alcohol consumed

Table 4 show results of the PONS study on annual amount of alcohol consumed per drinking person in the past 12 months. These data were calculated in liters for all alcohol products and separately for specific types of alcohol analyzed in the study. In this table data are presented for all subjects and for male and female respondents.

Total amount of alcohol (any product) drunk by PONS subjects was at level of 24.8 liters per drinking person. The alcohol volume was much higher among males (54.6 liters) than females (8.2 liters).

The biggest volume of alcohol consumed by PONS subjects concerned drinkers of wine produced from fruits other than grapes. They reported annual consumption of this alcohol product at the level of 55.4 liters per drinking person. PONS study subjects also drank a lot of beer (29 liters a year per drinking person). Annual consumption of grape wine reached almost 4 liters and vodka or other spirits 2.6 liters per drinking person.

Very big differences in volume of alcohol consumed annually were observed in gender groups. The biggest difference was noticed among subjects of PONS study who were drinking wine from other fruits than grapes (154.2 liters per drinking person among males and only 2.3 liters among females). Males participating in the study project also drank much more beer (45.5 liters), grape wine (6.2 liters) and vodka or other spirits (4.2 liters) as compared with participating females (respective alcohol volumes were 11.7, 3.14 and 1.4 liters per drinking person).

**Table 3.** Type of alcohol consumed by PONS subjects by selected socio-demographic strata

| Socio-demographic strata | Respondents drinking specific type of alcohol in the past 12 months (vs. not drinking) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Beer | | | Wine from grapes | | | Wine from other fruits | | | Vodka or other spirits | | |
| | N | % | Chi-square statistics | N | % | Chi-square statistics | N | % | Chi-square statistics | N | % | Chi-square statistics |
| Total (age 45-64) | 1708 | 54.03 | na | 1946 | 61.47 | na | 269 | 8.51 | na | 2382 | 75.36 | na |
| Gender | | | | | | | | | | | | |
| Males | 878 | 77.29 | 386.112 | 531 | 46.74 | 162.335 | 94 | 8.27 | 0.126 | 990 | 87.15 | 132.777 |
| Females | 830 | 40.99 | p=0.000 * | 1412 | 69.73 | p=0.000 * | 175 | 8.64 | p=0.722 | 1392 | 68.74 | p=0.000* |
| Males | | | | | | | | | | | | |
| Age | | | | | | | | | | | | |
| 45-54 years | 372 | 80.70 | 5.126 | 222 | 48.20 | 0.622 | 34 | 7.40 | 0.827 | 396 | 85.90 | 1.078 |
| 55-64 years | 506 | 75.00 | p=0.024* | 309 | 45.80 | p=0.430 | 60 | 8.90 | p=0.363 | 594 | 88.00 | p=0.299 |
| Residence | | | | | | | | | | | | |
| Rural | 278 | 78.31 | 0.307 | 128 | 36.06 | 23.689 | 29 | 8.17 | 0.008 | 326 | 91.83 | 10.111 |
| Urban | 600 | 76.82 | p=0.580 | 403 | 51.60 | p=0.000* | 65 | 8.32 | p=0.931 | 664 | 85.02 | p=0.001* |
| Females | | | | | | | | | | | | |
| Age | | | | | | | | | | | | |
| 45-54 years | 406 | 46.10 | 17.057 | 615 | 69.90 | 0.018 | 85 | 9.7 | 2.039 | 631 | 71.70 | 6.362 |
| 55-64 years | 424 | 37.00 | p=0.000* | 797 | 69.60 | p=0.892 | 90 | 7.9 | p=0.153 | 761 | 66.50 | p=0.012* |
| Residence | | | | | | | | | | | | |
| Rural | 225 | 35.16 | 13.155 | 399 | 62.34 | 24.175 | 90 | 14.06 | 34.824 | 477 | 74.53 | 14.601 |
| Urban | 605 | 43.68 | p=0.000* | 1013 | 73.14 | p=0.000* | 85 | 6.14 | p=0.000 * | 915 | 66.06 | p=0.000* |

na – not applicable; * Differences statistically significant; Chi-square statistics for distribution of drinking and not drinking of alcohol in the past 12 months among males versus females for:
Beer: age 45-54 years: Chi-square= 146.91, p=0.0001 *; age 55-64 years: Chi-square= 243.01, p=0.0001*
rural residence: Chi-square= 168.39, p=0.0001 *; urban residence: Chi-square= 220.89, p=0.0001*
Grape wine: age 45-54 years: Chi-square= 59.97, p=0.0001 *; age 55-64 years: Chi-square= 100.15, p=0.0001*
rural residence: Chi-square= 62.29, p=0.0001 *; urban residence: Chi-square= 101.41, p=0.0001*
Wine from other fruits: age 45-54 years: Chi-square= 1.68, p=0.1949; age 55-64 years: Chi-square= 0.47, p=0.493
rural residence: Chi-square= 6.98, p=0.008 *; urban residence: Chi-square= 3.37, p=0.066
Vodka or other spirits: age 45-54 years: Chi-square= 33.21, p=0.0001 *; age 55-64 years: Chi-square= 102.42, p=0.0001*
rural residence: Chi-square= 42.78, p=0.0001 *; urban residence: Chi-square= 89.86, p=0.0001*

**Table 4.** Annual amount of alcohol consumed per drinking person (in liters) by alcohol product and selected socio-demographic strata

| Social strata | Category | Any alcohol product | | | | Beer | | | | Wine from grapes | | | | Wine from other fruits | | | | Vodka and other spirits | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | N | Mean | SD* | p** | N | Mean | SD* | p** | N | Mean | SD* | p** | N | Mean | SD* | p** | N | Mean | SD* | p** |
| Total (aged 45-64) | | 3147 | 24.85 | 254.46 | na | 1703 | 29.04 | 54.68 | na | 1940 | 3.98 | 6.58 | na | 269 | 55.36 | 856.64 | na | 2375 | 2.58 | 5.67 | na |
| Gender | Males | 1129 | 54.64 | 422.6 | | 874 | 45.50 | 68.60 | | 530 | 6.21 | 8.77 | | 94 | 154.17 | 1448.96 | | 987 | 4.21 | 7.84 | |
| | Females | 2018 | 8.18 | 18.59 | 0.0001 | 829 | 11.70 | 24.41 | 0.0001 | 1410 | 3.14 | 5.31 | 0.0001 | 175 | 2.29 | 4.31 | 0.003 | 1388 | 1.43 | 2.86 | 0.0001 |

na – not applicable; * SD – standard deviation; **p – probability for Kruskal-Wallis ANOVA test

Gender differences in annual amount of alcohol consumed per drinking person were statistically significant for all types of alcohol products (p=0.0001 for drinking of any alcohol, beer, grape wine and vodka or other spirits and p=0.003 for drinking of wine from other fruits).

## Binge drinking

Table 5 includes data on frequency of binge drinking among PONS subjects who drank alcohol in the past 12 months. Binge drinking was defined as drinking more than 5 standard portions of alcohol per one occasion. This table shows data for all, male and female subjects of the PONS study.

Study results showed that binge drinking at daily and weekly basis was rare. More than 5 portions of alcohol at least once a week was drunk only by 0.8% of PONS subjects. However, group of respondents who were binge alcohol drinkers at monthly basis seem to be relatively big (6.7%). Most of participants of the PONS study were drinking a lot of alcohol per one occasion less than once a month (89.1%).

**Table 5.** Binge drinking among PONS subjects who drank alcohol in the past 12 months, by gender

| Social strata | Drinking more than 5 standard portions of alcohol per one occasion | | | | | | | | Chi-square statistics |
|---|---|---|---|---|---|---|---|---|---|
| | At least once a week | | At least once a month | | Less than once a month | | Do not know / Refusal | | |
| | N | % | N | % | N | % | N | % | |
| All subjects (aged 45-64) | 26 | 0.82 | 212 | 6.71 | 2815 | 89.05 | 108 | 3.42 | Not applicable |
| Gender | | | | | | | | | |
| Males | 21 | 1.85 | 170 | 14.96 | 906 | 79.75 | 39 | 3.43 | $Chi^2$=220.23 |
| Females | 5 | 0.25 | 42 | 2.07 | 1909 | 94.27 | 69 | 3.41 | p=0.00001 |

Frequency of binge drinking varied in gender groups being substantially more frequent in males than females (p<0.001). In males over 20% was drinking more than 5 portions of alcohol at weekly or monthly basis, in females only 6%. Although at very low level, binge drinking at least once a week was over 7 times higher among males (1.85%) than among females (0.25%). Similar gender differences were found for binge drinking at least once a month (15% in males, 2.1% in females).

Approximately 3% of male and female PONS subjects refused answer on the question on binge drinking or said they do not know the answer.

## Alcohol drinking before 12am

Data on alcohol drinking before 12am among PONS study subjects are included into Table 6. It was analyzed among persons who were drinking alcohol in the past 12 months and presented for all, male and female respondents.

Alcohol drinking before 12 am seem to occur not very often among participants of the PONS study (3.4%). However, there were clear differences in the analyzed indicator between male and female respondents of the PONS study sample. Drinking alcohol before 12 am was almost three times more often in males (5.9%) than in females (2.1%).

Very few PONS study subjects refused or did not know answer on this question (less than 0.1%).

**Table 6.** Alcohol drinking before 12 am among PONS subjects who drank alcohol in the past 12 months, by gender

| Social strata | Drinking alcohol before 12 am | | | | | | Chi-square statistics |
|---|---|---|---|---|---|---|---|
| | Yes | | No | | Do not know / Refusal | | |
| | N | % | N | % | N | % | |
| All subjects (aged 45-64) | 109 | 3.45 | 3049 | 96.46 | 3 | 0.09 | Not applicable |
| Gender | | | | | | | |
| Males | 67 | 5.90 | 1069 | 94.10 | 0 | 0.0 | $Chi^2$=33.560 |
| Females | 42 | 2.07 | 1980 | 97.78 | 3 | 0.1 | p=0.000 |

## DISCUSSION

Detailed data on alcohol drinking behaviors and patterns in adult population are fragmentary in Poland. Even the biggest datasets include only few questions on alcohol drinking. For example, the European Health Interview Survey (EHIS) that was carried out in Poland in 2009 by the Central Statistical Office asked about prevalence and frequency of alcohol drinking, volume of alcohol drunk at daily and weekly basis, and on prevalence and frequency of binge drinking (drinking 60 grams of pure alcohol per occasion at least two times a weeks) [17][1]. Therefore, results of the PONS cohort study seem to be valuable for analyzing the magnitude and patterns of alcohol drinking at population scale, however, they are difficult to be compared with other datasets.

Results of the PONS study give us a picture of alcohol drinking patterns among those inhabitants of Kielce town and surrounding rural area (Kielce county) who participated in the study. Below we are going to discuss if patterns of alcohol drinking presented in this paper can reflect alcohol behaviors of all adult inhabitants of the study area, whether they are internally consistent and consistent with other comparable datasets, and, what might be a crucial conclusion from the analysis of behaviors in a pilot group of the study subjects, in what way these data can be useful for improving research tools, planning next steps of the research project and

1. The EHIS was based on nation-wide representative sample of 25,500 households and 35,100 adults aged 15 years and over.

change health behaviors of inhabitants living in the PONS study area. Romundstad et al. conclude in separate paper on cancer risk factors that results of PONS study should help in increasing the population's awareness of risky lifestyle and in preventing the cancer risk [18].

Since alcohol control policy became more restrictive and binge drinking has left off socially accepted in some social strata, the reliable analysis of alcohol drinking in population studies is difficult, especially when subjective questionnaire methods are used. Methodological guidelines suggest few different interview approaches and mention tens of indicators for measuring the alcohol use [16,19,20]. However, most of methodological analyses are consistent with conclusion that one of the most reliable indicators for assessing the prevalence of alcohol drinking is a number of subjects who abstain from alcohol use [16,19,29]. EHIS suggests that collected survey data on prevalence of alcohol drinking, including percent of abstainers are more reliable than data on volume and structure of alcohol consumption [17].

The PONS study results indicated on very low percentage of lifetime alcohol drinking abstainers, especially among males (5% in males, 15% in females). However, number of current alcohol abstainers was much higher (42% in all subjects, 38% in males and 50% in females).

Another big difference that has been noticed between analyzed group of PONS subjects and respondents participating in other studies is much lower level of binge drinking in the PONS study. PONS results show that only 0.8% of adults aged 45-64 are binge drinkers at weekly basis, while in other studies this percentage varies from around 15% to 25% [5,17].

On the other side, it is worthy to indicate that results of PONS study seem to be consistent with other datasets as regards frequency of alcohol drinking and social patterns of alcohol drinking.

For example, similarly to results of other studies, male PONS subjects are characterized in comparison with females by much higher prevalence and frequency of current alcohol drinking and they are more often binge drinkers. Age and residence patterns of prevalence and frequency of alcohol drinking noticed among PONS subjects are also consistent with results of other studies on alcohol drinking [1,5,11,17].

The PONS study also indicated, as it was compared with patterns of drinking in female population, on bigger amount of alcohol consumed by males per occasion and at annual basis and more often among those subjects who drank alcohol before 12am. These observations seem to be logic and are consistent with findings from other studies in which alcohol drinking is considered both as common lifestyle risk factor and major contributor of premature mortality and injuries, especially in Central and Eastern part of Europe [1,5,10,11,21].

Finally, there is also a need to indicate on the concentration of alcohol drinking among male PONS subjects who were drinking wine produced from fruits other than grapes (so called "apple wine"). On the one side, this alcoholic product was not drunk very often by PONS respondents (8.3% of males, 8.6% of females). However, annual amount of this kind of wine consumed by drinking men was huge (154 liters per person) and very much differed from consumption observed among drinking females (2.3 liters a year per perosn). Since there is no cohort study data on drinking of apple wine in adult Polish population, we can not check whether PONS findings are valid and consistent. This phenomenon requires more detailed analysis within the PONS study project and national surveys, for example next round of EHIS.

## CONCLUSIONS

PONS study includes interesting dataset for assessing prevalence and patterns of alcohol drinking at population level. Alcohol drinking seems to be common among PONS subjects. However, comparison of the study project with available nation-wide surveys shows on much bigger proportion of alcohol abstainers and lower number of binge drinkers among participants of the PONS study.

On the other side, frequency and social patterns of alcohol drinking are similar to those observed in national studies. In the PONS study, males drink mainly vodka and beer, while consumption of vodka and wine from grapes dominate among females. Concentrated alcohol consumption (small number of alcohol drinkers consumes large volume of alcohol) concerns drinking of „apple wine" by males. Binge drinking and drinking alcohol before 12am are more frequent among males than females.

## ACKNOWLEDGEMENTS

The study was supported by a grant from the Polish-Norwegian Research Fund (PNRF-228-AI-1/07). Thanks are expressed to the members of the PONS project team, and to the participants for their contributions to the study.

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