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# Life expectancy and alcohol use health burden in Poland after 2002

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## ABSTRACT

**Introduction:** Between 1990 and 2002 Poland experienced one of the steepest gains in health in Europe. However, in 2002, unexpectedly, the health improvement in Poland halted. An increase in alcohol-related diseases after 2002 was most likely caused by an increase in alcohol consumption that followed a 30% reduction in excise tax on spirits and other weakening of alcohol control policies. This study examines the development of the health situation in Poland between 2002 and 2019, and describes potential causes of the health crisis, based on life expectancy statistics and epidemiological indicators of alcohol-related health burden.

**Material and methods:** We examined life expectancy and 100% alcohol-attributable death cases (AAC). Standardised death rates were calculated using population statistics from the World Bank and the Segi standard. Changes in trends were analysed using Joinpoint Regression. The present analysis comprises the Polish adult population aged 20+.

**Results:** The increase in life expectancy starting in 1991 in Poland first slowed down after 2002 and then stopped in 2014 in men and in 2016 in women. During the years 2002-2019, there was a manyfold linear growth of alcohol-attributable mortality in both sexes and all adult age groups. AAC standardised mortality rates increased from 7.5 (13.9 in men, 1.7 in women) in 2002 to 17.8 (29.3 in men, 7.1 in women) per 100,000 in 2019. The National Statistical Office recorded an increase of AAC deaths from 3685 (3256 in men and 429 in women) in 2002 to 10,396 (8251 in men, and 2145 in women) in 2019. During the years 2002-2019, the cumulative number of AAC deaths was 130,000 in men and women combined.

**Conclusions:** The halt in the improvement of health in Poland, probably caused by the increase in alcohol consumption, constitutes a serious public health challenge. Strong alcohol control action is urgently needed.

**KEY WORDS:** alcohol-attributable mortality, life expectancy, health decline, alcohol burden.

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## INTRODUCTION

After the political and economic changes that took place in Poland at the beginning of the 1990s, fast health improvements were observed. Between 1990 and 2002 Poland experienced one of the steepest gains in health in Europe. This was reflected in almost all health indicators. During this period life expectancy increased by 4 years among Polish men and 3 years among Polish women [1]. Poland experienced a strong decline in adult non-communicable diseases, probably due to, among other factors: very successful tobacco disease control, the "cardiovascular revolution", new medical technology and services, etc. [2-7].

In 2002, unexpectedly, the increase in life expectancy started to slow down [8]. Measured this way, improvements in health became less pronounced and then stopped. Since 2002 we have observed increasing trends of alcohol health burden indicators. Diagnosed

alcohol psychoses increased by 1/3 between 2003 and 2008 [9], and the years of life lost (YLL) due to alcoholic liver cirrhosis increased in Poland [10]. In the years 2002-2007, Poland experienced a freeze in the decline in premature mortality in young and middle-aged adults (aged 20-64 years) [8, 11]. The health crisis began, and it continues. Documented epidemiological analyses of the health situation strongly indicate that the health decline in Poland after 2002 was mainly caused by an increase in alcohol consumption and the resulting increase in alcohol-related deaths [9-16]. This serious health challenge has so far not been recognized and has not caught the attention of governmental health authorities, the inhabitants of Poland, or the vast majority of medical experts [8, 16-19].

The subject of the present paper is an analysis of the development of the health situation in Poland during the years 2002-2019 based on life expectancy at birth statistics and epidemiological indicators of alcohol health burden.

## MATERIAL AND METHODS

### LIFE EXPECTANCY

We used statistics on life expectancy at birth for men and women for the years 1991-2019 from the World Bank [20] and examined changes in life expectancy trends in Poland using Joinpoint Regression analysis.

### ALCOHOL-ATTRIBUTABLE MORTALITY

Estimating the alcohol-related health burden is difficult and requires special caution in Poland. To avoid these difficulties, a narrow group of causes of deaths was chosen, which are entirely (by definition) alcohol attributable (AAC). A list including the specific diseases indexed in the ICD10 is presented in Table 1. AAC mortality in the present analysis was used as a proxy to estimate the potential volume of alcohol burden in Poland.

Absolute numbers of AAC deaths for Poland were obtained from the World Health Organization Mortality database [21]. Standardised death rates (SDR) were calculated using population statistics from the World Bank [22]. Data were standardised using the Segi standard population [23]. Additionally, the share of AAC in all-cause mortality was calculated. The present analysis comprises the Polish adult population aged 20 years and more.

### JOINPOINT REGRESSION ANALYSIS

A Joinpoint Regression Analysis (Joinpoint Regression Program 4.6.0.0 – April 2018, available from the Surveillance Research Program of the US National Cancer Institute) was conducted to identify changes in life expectancy and AAC mortality trends during the studied period. This is a model that identifies those points in trend (joinpoints) where the linear slope of the trend changes significantly. Modelling with a maximum of 3 joinpoints (corresponding to up to 4 different trends) was applied. The software computed the Annual Percentage Change (APC) and Average Annual Percentage change (AAPC) with corresponding 95% confidence intervals to summarise changes in mortality trends between 2002 and 2019.

## RESULTS

### LIFE EXPECTANCY

Trends of life expectancy at birth in both men and women after 1990 consisted of a few periods (Figure 1). In men the highest absolute change in life expectancy was found in the beginning of the observation period, between 1991 and 2002 (difference of 4.3 years, APC = 0.5). Then the pace of increase slowed down to APC = 0.2 between 2002 and 2008, and life expectancy increased by 0.9 years at that time. During the years 2008-2014 it again increased faster with APC = 0.5 (increase by 2.4 years). In women, between 1991 and 1999, life expectancy increased by 2.2 years (APC = 0.4), and then until 2002 the pace increased (APC = 0.5). During the years 2002-2016, the trend was characterised by a slower pace of increase (APC = 0.3) and life expectancy increased by 3.2 years. During the last period, between 2014 and 2019, the trend in men was fairly constant with insignificant changes. In 2016, life expectancy in women started to decline, reaching 81.8 years in 2019.

### ALCOHOL-ATTRIBUTABLE HEALTH BURDEN IN POLAND

Mortality from AAC in the years 2002-2017 in Poland has been summarised elsewhere [15]. The present analysis documents an increase in mortality from AAC in both sexes and in all adult age groups between 2002 and 2019 (Figure 2). Mortality rates were considerably higher in men than in women; however, women experienced the largest increase in mortality in all adult age groups. In the studied period, male mortality doubled in the age group 20-44 years (to 18.6/100,000, and 1566 deaths in 2019) and in the age group 45-64 years (to 91.2/100,000 and 4,621 deaths in 2019), while in the oldest age group (65 years and more) mortality increased 4 fold (to 70.3/100,000 and 2062 deaths in 2019). Female mortality in the studied period increased 3 fold in the youngest women, aged 20-44 years (to 4.8/100,000 and 398 deaths in 2019), 4 fold in middle-aged women (to 23.0/100,000 and 1247 deaths in 2019), and 7 fold in the oldest age group (to 13.0/100,000 and 500 deaths in 2019). In 2002 the mortality sex ratio (quotient of SDR in men to SDR in women) amounted to 9.5 in the age group 65 years and above, 8.5 in age group 45-64 years, and 7.3 in age group 20-44 years. In 2019 the mortality sex ratio decreased to 5.4, 4.0, and 3.9, respectively in the 3 age groups. The percentage of AAC mortality in all-cause mortality in Poland increased in both men and women and in all adult age groups. It increased between

**TABLE 1.** Disease conditions causally (wholly and partially) related to alcohol with corresponding ICD-10 codes [42, 52]

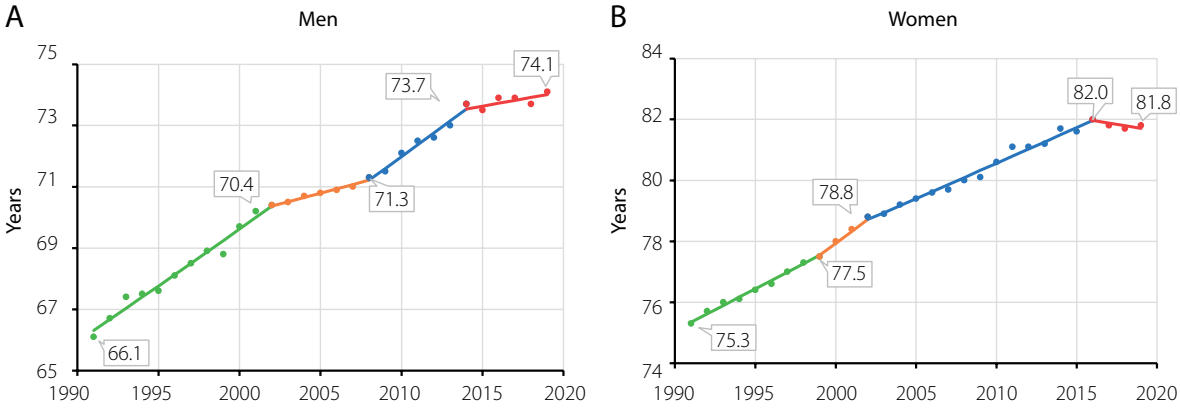
| 1. Causes of death wholly attributable to alcohol consumption (AAC)* | |
|---|---|
| **1.1. Mental and behavioural disorders due to use of alcohol** | **F.10** |
| Alcohol intoxication | F10.0 |
| Harmful use of alcohol | F10.1 |
| Alcohol dependence | F10.2 |
| Alcohol withdrawal state | F10.3 |
| Alcohol withdrawal state with delirium | F10.4 |
| Alcohol-induced psychotic disorder | F10.5 |
| Alcohol-induced amnesic syndrome | F10.6 |
| Alcohol-induced residual and late-onset psychotic disorder | F10.7 |
| **1.2. Poisoning due to alcohol** | |
| Accidental poisoning by and exposure to alcohol | X45 |
| Intentional self-poisoning by and exposure to alcohol | X65 |
| Poisoning by and exposure to alcohol, undetermined intent | Y15 |
| **1.3. Liver disorders due to alcohol** | **K70** |
| Alcoholic fatty liver | K70.0 |
| Alcoholic hepatitis | K70.1 |
| Alcoholic fibrosis and sclerosis of liver | K70.2 |
| Alcoholic cirrhosis of liver | K70.3 |
| Alcoholic hepatic failure | K70.4 |
| Alcoholic liver disease, unspecified | K70.9 |
| **1.4. Gastrointestinal disorders due to alcohol** | |
| Alcoholic gastritis | K29.2 |
| Alcohol-induced acute pancreatitis | K85.2 |
| Alcohol-induced chronic pancreatitis | K86.0 |
| **1.5. Other conditions due to alcohol** | |
| Alcohol-induced pseudo-Cushing's syndrome | E24.4 |
| Degeneration of nervous system due to alcohol | G31.2 |
| Alcoholic polyneuropathy | G62.1 |
| Alcoholic myopathy | G72.1 |
| Alcoholic cardiomyopathy | I42.6 |
| Maternal care for (suspected) damage to foetus from alcohol | O35.4 |
| Foetus and newborn affected by maternal use of alcohol | P04.3 |
| Foetal alcohol syndrome | Q86.0 |
| Excess blood alcohol | R78.0 |
| Toxic effect of alcohol | T51 |
| Evidence of alcohol involvement determined by blood alcohol level | Y90 |

| 2. Causes of death partly related to alcohol consumption (ARC) | |
|---|---|
| **2.1. Chronic and infectious disease conditions** | |
| Tuberculosis | A15-A19, B90 |
| HIV/AIDS | B20-B24 |
| Mouth, nasopharynx, other pharynx, and oropharynx cancer | C00-C13 |
| Oesophagus cancer | C15 |
| Stomach cancer | C16 |
| Colon and rectum cancer | C18-C21 |
| Liver cancer | C22 |
| Larynx cancer | C32 |
| Trachea, bronchus, and lung cancer | C33-C34 |
| Breast cancer (female) | C50 |
| Unipolar depressive disorders | F32, F33, F34.1 |
| Epilepsy | G40-G41 |
| Hypertensive heart disease | I11-I13 |
| Ischaemic heart disease | I20-I25 |
| Cardiomyopathy | I42 |
| Conduction disorders and other dysrhythmias | I47-I48 |
| Ischaemic stroke | I63-I67, I69.3 |
| Haemorrhagic and other non-ischaemic stroke | I60-I62, I69.0, I69.1, I69.2 |
| Lower respiratory infections: pneumonia | J09-J22, J85, P23 |
| Cirrhosis of the liver | K70, K73-K74 |
| Gallbladder and bile duct disease | K80-K83 |
| Pancreatitis | K85-K86 |
| Other digestive diseases | K20-K22, K28-K31, K38, K57-K63, K75.2, K75.3, K75.4, K76-K77, K90-K92** |
| Psoriasis | L40-L41 |
| **2.2. External causes of death partly related to alcohol consumption** | |
| 2.2.1. Unintentional injuries: | |
| Transport injuries (including road traffic accidents) | V01-V98, Y85.0 |
| Poisonings | X40-X44, X46-X49 |
| Falls | W00-W19 |
| Fires, heat, and hot substances | X00-X19 |
| Drowning | W65-W74 |
| Exposure to mechanical forces | W20-W52 |
| Natural disasters | X34-X39 |
| Adverse effects of medical treatment | Y40-Y84, Y88 |
| Injuries due to animal bites or contact with a marine animal | W53-W64, X20-X29 |
| Other unintentional injuries | W75-W99, X30-X33, X50-X58 |
| 2.2.2. Intentional injuries: | |
| Self-inflicted injuries | X60-X84, Y87.0 |
| Interpersonal violence | X85-Y09, Y87.1 |
| Collective violence | Y36, Y89.1 |
| Legally sanctioned deaths | Y35, Y89.0 |

*ICD10 – International Statistical Classification of Diseases and Related Health Problems 10th Revision*

**Data on alcohol-induced pseudo-Cushing's syndrome (E24.4), excess blood alcohol (R78.0), toxic effect of alcohol (T51), evidence of alcohol involvement determined by blood alcohol level (Y90) for both sexes, and alcoholic myopathy (G72.1) for women in Poland were not available. Furthermore, data on foetuses and newborns affected by maternal use of alcohol (P04.3), maternal care for (suspected) damage to foetus from alcohol (O35.4), and foetal alcohol syndrome (Q86.0) were excluded from the analysis because it concerns only adults.*

***(except K92.0, K92.1, K92.2, K92.9)*




| Period | Absolute change in years | APC | AAPC | 95% CI | *p* |
|---|---|---|---|---|---|
| 1991-2002 | 4.3 | 0.5 | | 0.5-0.6 | < 0.001 |
| 2002-2008 | 0.9 | 0.2 | | 0.1-0.3 | < 0.001 |
| 2008-2014 | 2.4 | 0.5 | | 0.4-0.7 | < 0.001 |
| 2014-2019 | 0.4 | 0.1 | | –0.1-0.3 | > 0.05 |
| 1991-2019 | 8.0 | | 0.4 | 0.3-0.5 | < 0.001 |

| Period | Absolute change in years | APC | AAPC | 95% CI | *p* |
|---|---|---|---|---|---|
| 1991-1999 | 2.2 | 0.4 | | 0.3-0.5 | < 0.001 |
| 1999-2002 | 1.3 | 0.5 | | 0.1-1.0 | < 0.001 |
| 2002-2016 | 3.2 | 0.3 | | 0.2-0.4 | < 0.001 |
| 2016-2019 | –0.2 | –0.1 | | –0.3-0.1 | > 0.05 |
| 1991-2019 | 6.5 | | 0.3 | 0.2-0.4 | < 0.001 |

*APC – annual percentage change, AAPC – average annual percentage change, CI – confidence interval*

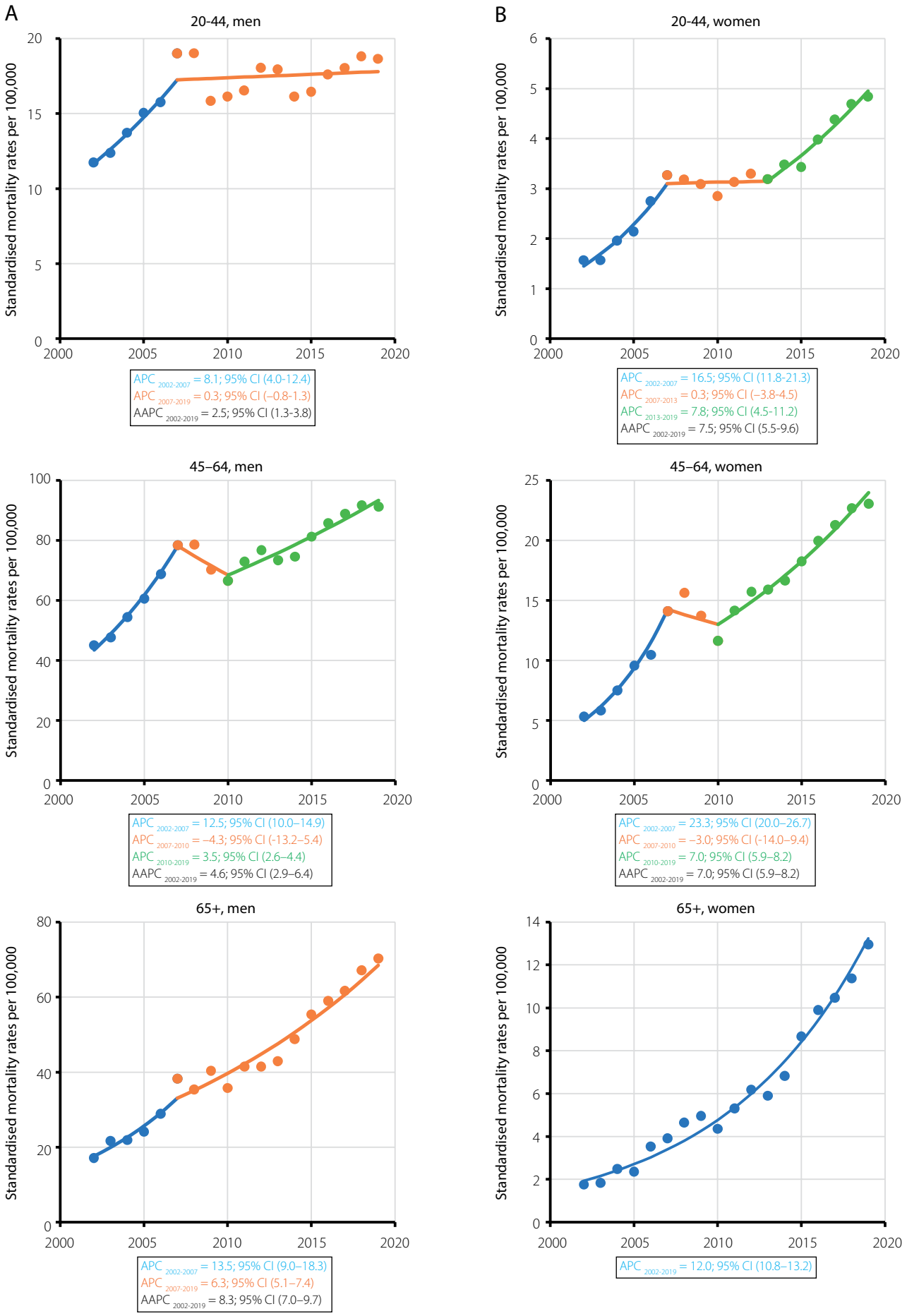
**FIGURE 1.** Life expectancy at birth in Poland, 1991-2019

2002 and 2019, and fastest in the oldest age groups in men (from 0.3% to 1.4%) and in women (from 0.04% to 0.3%); however, the share of AAC mortality in all-cause mortality in Poland in 2019 was the highest in the youngest age group in men (12.6%) and in women (11.0%). In middle-aged men and women, the share of AAC in all-cause mortality was lower than in the age group 20-44 years; however, it was substantial: 8.4% in men and 5.2% in women.

During 17 years of observation, the cumulative number of AAC deaths was 130,000 (105,486 in men and 21,983 in women). The majority of them (63%) were middle-aged (65,686 men, 14,263 women aged 45-64 years), 21% were aged 20-44 years (22,601 men and 4,275 women), and 16% were aged 65 years and above (17,119 men and 3,428 women).

Analysis of percentage share of specific diseases included in AAC in 2002 and 2019 (calculated from number of deaths in age group 20+ years) showed that in 2002 three major disease entities constituted more than 90% of all causes wholly attributable to alcohol consumption: mental and behavioural disorders due to use of alcohol (F10), accidental poisoning by exposure to alcohol (X45), and alcoholic liver cirrhosis (K70). However, in men mental and behavioural disorders accounted for the largest share (34.6%), while in women this was the case for alcoholic liver cirrhosis (37.6%). In 2019 the percentage share changed substantially. The main disease, which accounted for 50% in men and almost 70% in women (68.8%), was alcoholic liver cirrhosis. The second disease was a group of mental and behavioural disorders due to use of alcohol, which accounted for 34.5% in men and 22.6% in women.

Analysis of trends using Joinpoint regression showed that the most striking increase in AAC mortality rates in both men and women was between 2002 and 2007 (Figure 2). In men aged 20-44 years the APC in the years 2002-2007 was 8.1%, and after 2007 until the end of the observation period the trend did not change substantially. In men aged 45-64 years the APC between 2002 and 2007 was 12.5%. Then the trend showed an insignificant decrease, and from 2010 to 2019 it increased again, but with a slower pace (APC = 3.5%). In men aged 65 years and above, the trend rose between 2002 and 2007 with an APC of 13.5%, and then from 2007 to 2019 with slower pace (APC = 6.3%). In women, in the age group 20-44 years, AAC mortality increased between 2002 and 2007 with an APC of 16.5%, then the trend showed insignificant changes, and from 2013 it started to increase again, with an APC of 7.8%. In women aged 45-64 years the trend increased between 2002 and 2007, with an APC of 23.3%, then it showed insignificant changes, and from 2010 it started to increase again with a slower pace (APC = 7.0%). Women aged 65 years and older were the only group in which the AAC mortality trend increased constantly during the whole observation period, with an APC of 12.0%. The AAPC was significant in both sexes and all adult age groups, but values were found to be higher in women than in men (Figure 2).




*APC – annual percentage change, AAPC – average annual percentage change*

**FIGURE 2.** Trends in alcohol-attributable causes (AAC) mortality in Poland, 2002-2019

## DISCUSSION

Health is one of the basic factors in the development of every community. In the most developed European countries, health has always been one of the most basic factors of importance to their growth. This is the case in the Scandinavian countries, the UK, and the USA. However, it has never been the most important factor of state policy in Poland. In 1919, in the beginning of the rebuilding of the Republic of Poland, a Professor of the Jagiellonian University, Emil Godlewski, wrote that "the greatest property of the state is the life and health of its citizens" [24]. Constant monitoring of the development of the health situation is one of the basic duties of the state.

In the present study, we used mortality data as a key source of information about changes in population health. Mortality data provide undeniable, reliable, and unquestionable indicators for assessing changes in health over time and across populations. Life expectancy at birth, which is based on mortality statistics, is used as the best summary health measure. It is a substantial component of the Human Development Index (HDI) – a synthetic measure used by the United Nations to compare socio-economic development and quality of life between countries. Generally, life expectancy fluctuated significantly in Poland after the Second World War, unlike in most Western countries of the world. Unlike some politically and economically stable countries such as Sweden, Poland has shown patterns of changes in life expectancy characterised by alternating increases and decreases [1] (Appendix 1).

In the beginning of the 21st century, a health crisis emerged in Poland. By 2020, alcohol consumption increased by 50% [12, 13]. Probably, the factors explaining this strong increase in alcohol consumption were a 30% decline in the excise tax on spirits, which took place in October 2002 [25], a broad weakening of alcohol policy regulations, and economic affordability [12, 13]. The increase in population alcohol consumption in Poland has now already lasted for 20 years. From 2002 until the start of the coronavirus pandemic, population alcohol consumption was the only major risk factor that could be responsible for these unfavourable changes in health. Then, in March 2020, the coronavirus pandemic started in Poland, which led to an additional increase in health burden.

Poland has one of the highest levels of premature adult mortality (before 65 years of age) among European Union countries [7, 26-28]. There are many reasons for this. However, the cause of the currently observed health decline (2002-2019) seems to be the increase in alcohol-related deaths. The hypothetical main cause is alcohol, the consumption of which in Poland is one of the highest in Europe and in contrast to the many European countries has been growing in the last 2 decades [16, 29-32]. An important risk factor for high premature mortality in Poland is environmental pollution. Environmental pollution has, however, not increased in Poland during the last decade [33]. In addition, despite the huge drop in tobacco consumption and sale in Poland from around 80 billion in 2002 to around 40 billion cigarettes in 2019, 6.8 million Poles still smoke daily [2, 34]. Also, enormous progress in changing the structure of fat consumption (increased consumption of vegetable oils vs a decline in animal fat intake), mostly in the 1990s, has been made [5, 35, 36]. It is also worth mentioning that during the decades before the start of the coronavirus pandemic era in 2020 there were no substantial adverse changes in the functioning of curative medicine in Poland. The observed health decline can therefore not be explained by changes in medical services.

While historically Europe has been a region with the highest consumption of alcohol in the world, in 1950-1970 Poland was not in the top of the list. At that time alcohol consumption in the Mediterranean and Balkan countries was the highest in the world and reached the level of 20-23 litres of pure alcohol per capita per year among those aged 15 years or more [29]. Consequently, these countries were characterized by the highest morbidity and mortality rates due to alcohol-related diseases, i.e. alcoholic liver cirrhosis, oral cancer, laryngeal cancer, oesophageal cancer, alcoholic psychoses, and others [37].

At the time, alcohol consumption in Poland fluctuated on a level around 5-8 litres of pure spirit per capita per annum [29] (Appendix 2). In reaction to the alarming level of alcohol-related conditions in Europe, many countries took appropriate steps, which led to a decline in alcohol intake [38]. In consequence, during the last decades in Europe, alcohol consumption and alcohol-related diseases declined substantially. In France, consumption of alcohol decreased to 11 litres and in Italy to 8 litres of pure alcohol per capita in 2019. Decreased alcohol consumption in France, Italy, and other Mediterranean countries was followed by substantial decreases in alcohol-related morbidity and mortality, and the most spectacular decrease in alcoholic liver cirrhosis, and cancers of the larynx and oesophagus [26, 37].

It is worth mentioning (something that is not commonly recognized) that between 1985 and 2002 alcohol consumption in Poland fluctuated at a level below the European average [29]. Successful alcohol control in Poland at the time was a result of a Scandinavian-like comprehensive alcohol control act introduced on the initiative of the Solidarity social movement in 1982 [39]. A comprehensive analysis of alcohol policy in 30 OECD countries conducted by Brand *et al.* showed that Poland and Norway were described as countries with the most comprehensive and effective alcohol control regulations and successfully introduced policies [40]. This was confirmed by the relatively low level of alcohol-related burden of diseases in Poland at that time. Unfortunately,

from the beginning of the 21st century this control policy was dramatically weakened.

To assess alcohol-related burden, it is necessary to systematize the knowledge of how alcohol works on the human body, and it should be emphasized how important the level of population alcohol consumption is to public health.

Despite its widespread availability and popularity in European countries, alcohol is not a simple, ordinary commodity [41]. It is a psychoactive, addictive, toxic, and carcinogenic substance. There is no safe lower dose of alcohol intake for humans [42]. It is a causal factor in more than 200 disease and injury conditions. Most of them have multifactorial aetiologies where alcohol is one of the causal components. Alcohol affects a wide range of structures and processes in the central nervous system. Regardless of dose, alcohol always induces brain damage, especially of the frontal lobe of the brain responsible for thinking, decision making, and planning, for speech, personality, concentration, and motor skills. Drinking alcohol is associated with a risk of developing mental and behavioural disorders, including alcohol dependence, and major noncommunicable diseases such as liver cirrhosis and cardiovascular diseases. It is also carcinogenic and has causal relations with several cancer types (i.e. head and neck cancers, cancers of the oral cavity, pharynx, larynx, and liver, oesophageal, and female breast) [43]. As an immunosuppressant, alcohol increases the risk of communicable diseases, including tuberculosis and HIV, and probably also COVID-19. Furthermore, alcohol is extremely toxic to the foetus and its developing tissues. A significant proportion of the disease burden attributable to alcohol consumption arises from unintentional and intentional injuries (i.e. road traffic crashes, violence, suicides, homicides, fatal alcohol-related injuries, and psychoses). The risk of the wide range of health and social harms increases with the volume of lifetime alcohol use, frequency and style of drinking (Mediterranean or binge-drinking style), etc. [42].

It should also be mentioned that there is a body of scientific literature suggesting the protective effect of drinking alcohol, especially on cardiovascular diseases. Analyses of the reduced risk of cardiovascular deaths are especially often published on the basis of data from Western countries. However, in the countries of Central and Eastern Europe, especially in those where the binge-drinking style predominates, the significance of this phenomenon is disputed [44, 45]. This phenomenon occurs in narrow scope, and its size seems to be under discussion. Many publications question the value of the protective effect of alcohol from the point of view of public health, and postulate that the population-related health damage of cardiovascular disease (CVD) resulting from alcohol is higher than the CVD fraction resulting from the protective effect of alcohol [45]. This phenomenon requires further in-depth epidemiological analyses.

Hence, an important indicator of the health threat is the level of population alcohol consumption. The natural experiment (the sudden, sharp, significant increase in health risk related to one factor only) that took place in Poland during the period 2002-2019 has obviously contributed to an increase in population health burden.

Most probably, as a result of the increase in alcohol consumption, in all adult age groups and in men as well as in women, there has been a linear growth of 100% in the alcohol-attributable (AAC) mortality rate [14, 15], including alcoholic liver cirrhosis. However, it must be mentioned that the increase in alcohol liver cirrhosis mortality in recent years in Poland is additionally significantly modified by the so-called "reservoir effect" (a sudden increase in mortality from ALC in the population that has been drinking significant amounts of alcohol for many years) [14, 26, 46] (Appendix 2).

However, at the same time, this dramatic development is in contrast to a strong decline in tobacco consumption, leading to decreased tobacco-attributable and -related deaths from, among others, cardiovascular diseases and lung cancer. All these groups of diseases have significantly decreased at the same time, mainly thanks to the extraordinary declining population consumption of cigarettes in Poland (from around 80 billion cigarettes in 2002 to around 40 billion in 2019) (Appendix 2) [2, 4, 7, 34, 47, 48]. This interaction (an increase in alcohol exposure with a simultaneous decline in tobacco consumption) requires further in-depth research.

The alcohol health burden includes a group of death causes that are wholly (100%) attributable to alcohol consumption (AAC – alcohol-attributable causes) and those where alcohol is one of the potential risk factors (ARC – alcohol-related causes). AAC include a dozen disease conditions that are by definition causally attributed to alcohol. This group represents diseases that are reliably connected with alcohol consumption, i.e. alcoholic liver cirrhosis, alcoholic psychosis, dependency and abuse, alcoholic cardiomyopathy, alcohol poisoning, and others [42]. That is why the present study focused on AAC mortality as a proxy that could show if the observed excess alcohol mortality could be caused by an increase in alcohol consumption in Poland and to what extent.

Estimating the alcohol burden of non-communicable chronic diseases of adults in Poland is particularly difficult and can provide misleading conclusions [8, 16, 17, 49]. This is, among others, due to the fact that during the years 2002-2019 the time trends in the consumption of alcohol and tobacco diverged in Poland, unlike in most European countries. This has led, among others, to the publication of Polish and international reports in recent years, which did not mention the increase in the burden of all alcohol-related (AAC and ARC) diseases in Poland.

The "Status report on alcohol consumption and policy responses in 30 European countries" published in 2019

[49] illustrates the importance of the selection of time points for research analysis. Failure to examine changes over longer periods of time can lead to misinterpretations of alcohol harm changes and misleading conclusions. A 2019 WHO report indicated that Poland was a country with a decreasing proportion of alcohol-attributable mortality. Choosing the years 2010 and 2016 to determine changes in the alcohol health burden has led the authors of this otherwise important publication to an incorrect conclusion for Poland. Similarly, a report of the National Institute of Public Health, "Health status of Polish population and its determinants" from 2018 [17], did not warn of the rising trend in alcohol consumption nor recognize the growing epidemic of alcohol deaths in Poland. Furthermore, a report from 2020 [8] estimated the total number of alcohol-related deaths (AAC plus ARC) to be around 12,000 in 2018 in Poland (this corresponds to less than 3% of the total number of deaths in 2018 in Poland).

This is a gross underestimation of alcohol harm in Poland. These numbers were repeated many times by the state administration, as well international bodies, in national and international public health reports.

The analysis presented in this publication has focused on estimating only 100% alcohol-attributable causes of deaths (AAC) and did not include the remaining alcohol-related causes of death (ARC). Inclusion of all alcohol-related deaths (AAC plus ARC) should provide estimates many-fold higher than abovementioned value.

Additionally, a report from the World Health Organization estimated more than 6000 deaths as a result of alcohol-related cancers and more than 1500 deaths as a result of alcohol-related injuries in 2016 in the age group 15 years and older in Poland [31]. The WHO 2016 report did not provide separate estimates of deaths from cardiovascular diseases. However, to determine the real size of total alcohol burden in Poland (AAC plus ARC), it is necessary to conduct thorough research using appropriate methods corresponding to Polish epidemiological circumstances in recent decades. Simple, preliminary calculations indicate that the total number of alcohol-related deaths (wholly plus partially resulting from alcohol consumption) could be estimated at around 30,000 per year (which constitutes around 7% of the absolute number of deaths from all causes in 2019). And the figure of 12,000 deaths from AAC and ARC presented in the report from 2020 [8] seems to be significantly underestimated.

The presented study has some limitations. First, this is an ecological study. In our work the calculated AAC mortality was used only as an indicator – a proxy for global alcohol-related mortality. Also, the presented analysis did not examine correlations between alcohol-related mortality and trends in life expectancy. We did not make any attempt to estimate the alcohol-related burden of deaths in general. Additionally, the estimation presented in the discussion is oversimplified to illustrate the potential magnitude of the phenomenon.

An important matter is the quality of data used in the analysis. While the death statistics in Poland are complete, the quality of the diagnostics, especially in rare diseases, is challenging [50]. This also applies to the death statistics due to diseases attributed to alcohol use. While the medical identification of ALC appears to be easy, primarily because of the characteristics of the disease, most of the conditions listed in Table 1 may raise diagnostic

**BOX 1.** The 2002 turning point – summary of the health decline in Poland

1. After a sharp increase in life expectancy since the early 1990s, unexpectedly in 2002 health growth in Poland has slowed down. Since 2014 in men and 2016 in women the **increase in life expectancy in Poland has halted**.
2. From the beginning of the 21st century, a **weakening of the Polish government's alcohol control policy** has been observed. In October 2002, the **excise tax on spirits was reduced by 30%** [25], and in 2001 the beer regulations were suspended. Beer advertising was re-introduced on television. Also, in 2010 the alcohol industry launched an ongoing marketing campaign leading to a dramatic increase in sales of small bottles of vodka. In 2019 1.2 billion small bottles of vodka were sold in Poland [13].
3. **Recorded per capita consumption (15+) increased** from 8.1 litres of pure spirit in 2002 to 11.7 litres in 2020. Recorded alcohol consumption (15+) in Poland increased by 125 million litres, from 254 million litres of pure spirit in 2002 to 379 million litres in 2020 [29]. The **structure of alcohol consumption has changed significantly**; at the end of the 1990s, vodka, which was the main type of alcohol consumed throughout the post-war period, was replaced by beer, which started to be the most consumed alcohol in Poland [13] (Appendix 3).
4. **Mortality from 100% alcohol-attributable causes** (AAC) increased in Poland: standardised mortality rates from AAC increased from 7.5 (13.9 in men, 1.7 in women) in 2002 to 17.8 per 100,000 (29.3 in men, 7.1 in women) in 2019. The National Statistical Office recorded an increase in AAC deaths from 3685 (3256 in men and 429 in women) in 2002 to 10,396 (8251 in men and 2145 in women) in 2019. During the period 2002-2019, the cumulative number of AAC deaths was 130,000 for both sexes combined [15].
5. The main cause of deaths among AAC was **alcoholic liver cirrhosis (ALC)**. In 2019 ALC accounted for 50% of AAC deaths in men and 69% of AAC deaths in women. Between 2002 and 2019 mortality from ALC increased in Poland markedly in both sexes and all adult age groups [14]. Standardised mortality rates from ALC increased from 2.2 (3.9 in men, 0.6 in women) in 2002 to 9.5 per 100,000 (14.6 in men, 4.8 in women) in 2019, and the annual number of ALC deaths increased from 1079 (918 in men and 161 in women) to 5613 (4138 in men, and 1475 in women), respectively. During the period 2002-2019, the cumulative number of ALC deaths was 57,000 for both genders combined.

concerns, which are often the cause of underestimating deaths. On this basis, it should be concluded that the number of deaths attributed to alcohol is probably underestimated in Poland.

## CONCLUSIONS

Since 2002, health improvement in Poland slowed down, and in recent years stopped, even showing a decreasing tendency. Epidemiological analyses indicate rising mortality from alcohol-attributable causes. This developing crisis seems to have led to a reduction in life expectancy taking place during the last few years. The alcohol-related health burden has lasted for several years in Poland and seems to be in the process of getting worse.

The picture painted in this publication calls for immediate in-depth comprehensive epidemiological analysis and public health action. Poland must re-establish population-based public health programmes, especially an alcohol control programme similar to the one which was essentially weakened at the beginning of the 21st century. It should include anti-promotional pricing, alcohol advertising bans, measures to limit the availability of alcohol, well-funded educational campaigns, continuous and significant increases in taxes on alcohol, and a system for monitoring the alcohol-related health burden. Given that the ongoing COVID-19 crisis in 2020 and 2021 exacerbated the harmful effects of alcohol consumption to extremely high levels of health burden [51], it is time to safeguard the public interest and take immediate action against the alcohol epidemic in Poland. Without this, further economic and social development in Poland will be seriously hampered.

## DISCLOSURE

The authors report no conflict of interest.

### References

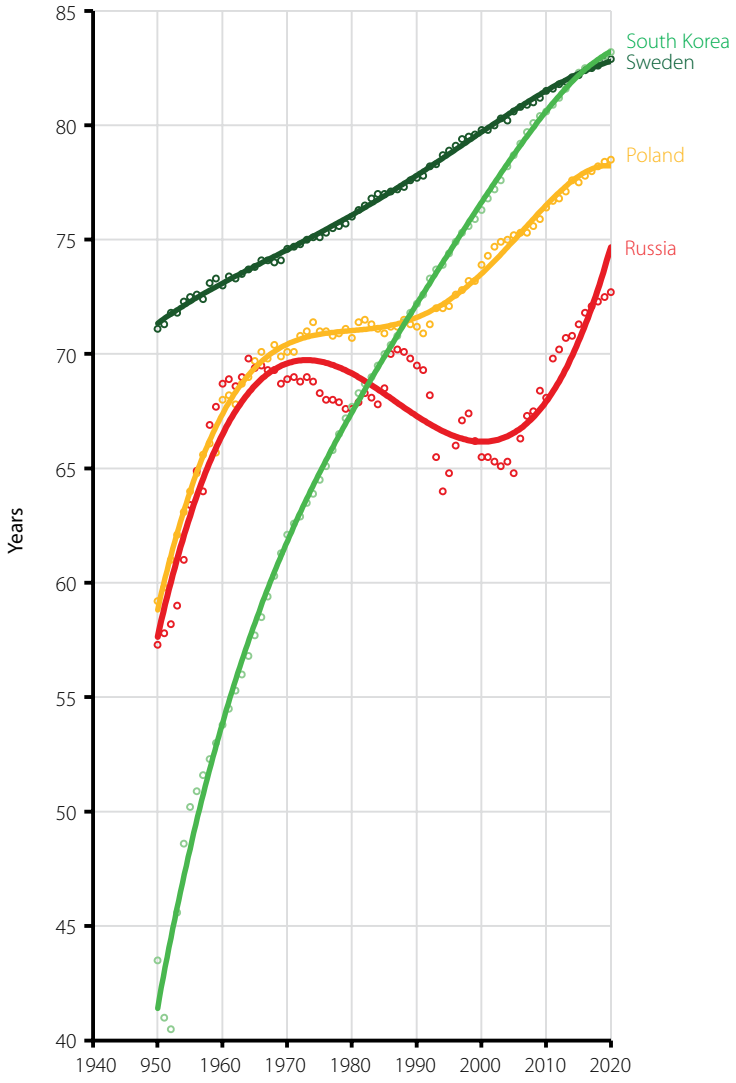

1. Zatoński WA. One hundred years of health in Poland. J Health Inequal 2019; 5(1): 11-19.
2. Zatoński WA, Zatoński M, Janik-Koncewicz K, et al. Hundred years of cigarette smoking in Poland: three phases of the tobacco epidemic. J Health Inequal 2017; 3(2): 118-122.
3. Hoffman SJ, Mammone J, Rogers Van Katwyk S, et al. Cigarette consumption estimates for 71 countries from 1970 to 2015: systematic collection of comparable data to facilitate quasi experimental evaluations of national and global tobacco control interventions. BMJ 2019; 19: 12231.
4. Zatoński WA, Janik-Koncewicz K, Zatoński M. Role of primary prevention in lung cancer control in Poland. J Thorac Oncol 2021; 16(10): e93-e94.
5. Zatoński WA, McMichael AJ, Powles JW. Ecological study reasons for sharp decline in mortality from ischaemic heart in Poland since 1991. BMJ 1998; 316(7137): 1047-1051.
6. Statement from Prof. Grzegorz Opolski. In: Zatoński WA. One hundred years of health in Poland. J Health Inequal 2019; 5(1): 11-19.
7. Zatoński WA, Bhala N. Changing trends of diseases in Eastern Europe: closing the gap. Public Health 2012; 126: 248-252.
8. Wojtyniak B, Goryński P (eds.). Health status of Polish population and its determinants, 2020. Available from: http://bazawiedzy.pzh.gov.pl/wydawnictwa (accessed: 15 December 2021).
9. Moskalewicz J, Wieczorek Ł. Dostępność, konsumpcja alkoholu i konsekwencje picia – trzy dekady doświadczeń [Affordability and availability, alcohol consumption and consequences of drinking – three decades of experiences]. Alkoholizm i Narkomania 2009; 22: 305-337.
10. Ciabiada-Bryła B, Maniecka-Bryła I, Paciej-Gołębiowska P. Years of life lost due to alcohol-related mortality: a nationwide population study in Poland, 1999-2017. Drug Alcohol Depend 2021; 227: 108990.
11. Zatoński WA, Sulkowska U, Zatoński MZ, et al. Alcohol taxation and premature mortality in Europe. Lancet 2015; 385(9974): 1181.
12. Zatoński WA. The alcohol crisis in Polish public health. J Health Inequal 2019; 5(2): 122-123.
13. Zatoński WA, Młoźniak I, Zatoński M, Gruszczyński Ł. Small bottles – huge problem? A new phase of Poland's ongoing alcohol epidemic. J Health Inequal 2019; 5(1): 86-88.
14. Zatoński WA, Zatoński MZ, Janik-Koncewicz K, McKee M. Alcohol-related liver cirrhosis in Poland: the reservoir effect. Lancet Gastroenterol Hepatol 2020; 5(12): 1035.
15. Zatoński WA, Zatoński M, Janik-Koncewicz K, Wojtyła A. Alcohol-related deaths in Poland during a period of weakening alcohol control measures. JAMA 2021; 325(11): 1108-1109.
16. Zatoński WA, Janik-Koncewicz K, Zatoński M, Wojtyła A. Health decline in Poland after 2002: response to a recent analysis of the changes in disease burden in Poland. J Health Inequal 2021; 7(1): 2-6.
17. Wojtyniak B, Goryński P (eds.). Health status of Polish population and its determinants – in short. National Institute of Public Health – National Institute of Hygiene, Warsaw 2018.
18. Fal AM (ed.) Alkohol w Polsce. Kontekst społeczny, rynkowy i legislacyjny [Alcohol in Poland. Social, market and legislative context]. Pracodawcy Rzeczpospolitej Polskiej, Warszawa 2020.
19. Gańczak M, Miazgowski T, Kożybska M, et al. Changes in disease burden in Poland between 1990-2017 in comparison with other Central European countries: a systematic analysis for the Global Burden of Disease Study 2017. PLoS One 2020; 15(3): e0226766.
20. World Bank. Life expectancy at birth. Available from: https://data.worldbank.org/indicator/SP.DYN.LE00.IN (accessed: 15 February 2022).
21. World Health Organization Mortality database. Available from: https://www.who.int/data/data-collection-tools/who-mortality-database (accessed: 14 October 2021).
22. World Bank. Population. Available from: https://data.worldbank.org/ (accessed: 14 October 2021).
23. Ahmad OB, Boschi-Pinto C, Lopez AD, et al. Age standardization of rates: a new WHO standard. Available from: https://www.who.int/healthinfo/paper31.pdf (accessed: 17 October 2020).
24. Chwalba A. 1919. Pierwszy rok wolności [1919. The first year of freedom]. Wydawnictwo Czarne, Wołowiec 2019.
25. Ordinance of the Minister of Finance of August 1, 2002 amending the ordinance on excise duty]. Dz.U. Nr 125 poz. 1065.

Available from: https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20021251065 (accessed: 15 January 2022).
26. Zatoński W and the HEM project team. Closing the health gap in European Union. The Maria Skłodowska-Curie Memorial Cancer Center and Institute of Oncology, Warsaw 2008.
27. Zatoński M, Zatoński WA, Wojtyła A. Premature mortality: Europe's persisting Iron Curtain? J Health Inequal 2016; 2(1): 3-6.
28. Janik-Koncewicz K, Herbeć A, Zatoński M, et al. Building health literacy in a Polish region: protocol for the POWER project in Lower Silesia. J Health Inequal 2018; 4(1): 27-30.
29. OECD data. Alcohol consumption. Available from: https://data.oecd.org/healthrisk/alcohol-consumption.htm (accessed: 15 September 2021).
30. GBD 2016 Alcohol Collaborators. Alcohol use and burden for 195 countries and territories, 1990-2016: a systematic analysis for the Global Burden of Disease Study 2016. Lancet 2018; 392(10152): 1015-1035.
31. World Health Organization. Global status report on alcohol and health 2018. Available from: https://apps.who.int/iris/bitstream/handle/10665/274603/9789241565639-eng.pdf (accessed: 17 September 2021).
32. OECD. Health at a Glance 2021. OECD Indicators. Available from: https://www.oecd.org/health/health-at-a-glance/ (accessed: 31 January 2022).
33. Samet J, Buran M. The burden of avoidable disease from air pollution: implications for prevention. J Health Inequal 2020; 6(1): 2-6.
34. Janik-Koncewicz K, Zatoński W, Zatońska K, et al. Cigarette smoking in Poland in 2019: the continuing decline in smoking prevalence. J Health Inequal 2020; 6(2): 87-94.
35. Janik-Koncewicz K, Zatoński WA, Herbeć A, Zatońska K. Unsaturated fat and cardiovascular health in Poland. J Health Inequal 2016; 2(1): 63-66.
36. Zatoński W, Willett W. Changes in dietary fat and declining coronary heart disease in Poland: population based study. BMJ 2005; 331: 187-188.
37. Malvezzi M, Negri E, La Vecchia C. History of alcohol consumption and cancer burden in Italy. J Health Inequal 2021; 7(2): 96-101.
38. d'Houtaud A, Adriaanse H, Field MG. Alcohol consumption in France: production, consumption, morbidity and mortality, prevention and education in the last three decades. Adv Alcohol Subst Abuse 1989; 8(1): 19-44.
39. Moskalewicz J. Lessons to be learnt from Poland's attempt at moderating its consumption of alcohol. Addiction 1993; 88 (Suppl): 135S-142S.
40. Brand DA, Saisana M, Rynn LA, et al. Comparative analysis of alcohol control policies in 30 countries. PLoS Med 2007; 4(4): e151.
41. Babor TF, Babor T, Caetano R, et al. Alcohol: no ordinary commodity. Oxford University Press, Oxford 2010.
42. Rehm J, Baliunas D, Borges GLG, et al. The relation between different dimensions of alcohol consumption and burden of disease: an overview. Addiction 2010; 105(5): 817-843.
43. World Health Organization. Alcohol Drinking. IARC Monographs on the Evaluation of the Carcinogenic Risks to Humans Volume 44. IARC, Lyon 1988.
44. Bagnardi V, Zatonski W, Scotti L, et al. Does drinking pattern modify the effect of alcohol on the risk of coronary heart disease? Evidence from a meta-analysis. J Epidemiol Community Health 2008; 62: 615-619.
45. Zaridze D, Brennan P, Boreham J, et al. Alcohol and cause-specific mortality in Russia: a retrospective case-control study of 48 557 adult deaths. Lancet 2009; 373(9682): 2201-2214.
46. Norstrom T, Skog OJ. Alcohol and mortality: methodological and analytical issues in aggregate analyses. Addiction 2001; 96 (Suppl 1): S5-S17.
47. Zatoński WA, Zatoński M. Poland's rapid lung cancer decline in the years 1990-2016. The first step towards the eradication of lung cancer in Poland. Health Prob Civil 2017; 11(4): 211-225.
48. Zatoński WA, Tukiendorf A, Zatoński M, et al. Lung cancer mortality decline among middle-aged men and women in Poland and the UK. J Health Inequal 2017; 3(2): 123-126.
49. World Health Organization. Status report on alcohol consumption, harm and policy responses in 30 European countries 2019. Available from: https://www.euro.who.int/__data/assets/pdf_file/0019/411418/Alcohol-consumption-harm-policy-responses-30-European-countries-2019.pdf (accessed: 12 December 2021).
50. Majewska J. The quality of mortality data. Studia Ekonomiczne. Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach 2017; 344: 76-96.
51. White AM, Castle IP, Powell PA, et al. Alcohol-related deaths during the COVID-19 pandemic. Available from: https://jamanetwork.com/journals/jama/fullarticle/2790491?guestaccesskey=f7d07061-24d6-42a0-9b07-d25437014052&utm_source=silverchair&utm_medium=email&utm_campaign=article_alert-jama&utm_term=mostread&utm_content=olf-widget_03252022 (accessed: 31 January 2022).
52. Roberts E, Morse R, Epstein S, et al. The prevalence of wholly attributable alcohol conditions in the United Kingdom hospital system: a systematic review, meta-analysis and meta-regression. Addiction 2019; 114(10): 1726-1737.

**AUTHORS' CONTRIBUTIONS**

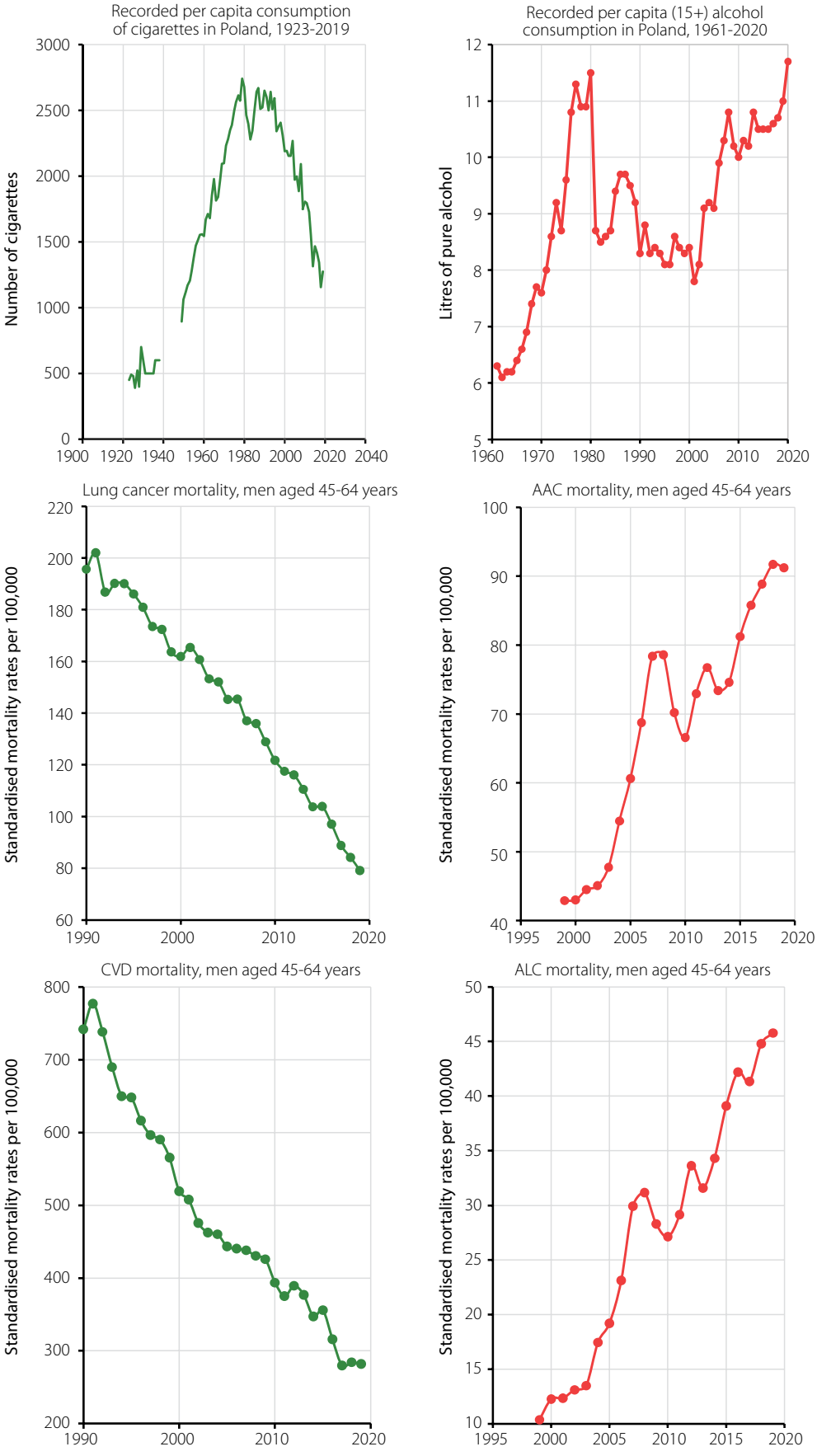
WAZ, MZ prepared the concept of the publication. KJK collected and analysed data. WAZ, KJK prepared the final version of the manuscript.

**APPENDIX 1.** Life expectancy at birth 1950-2020, both sexes



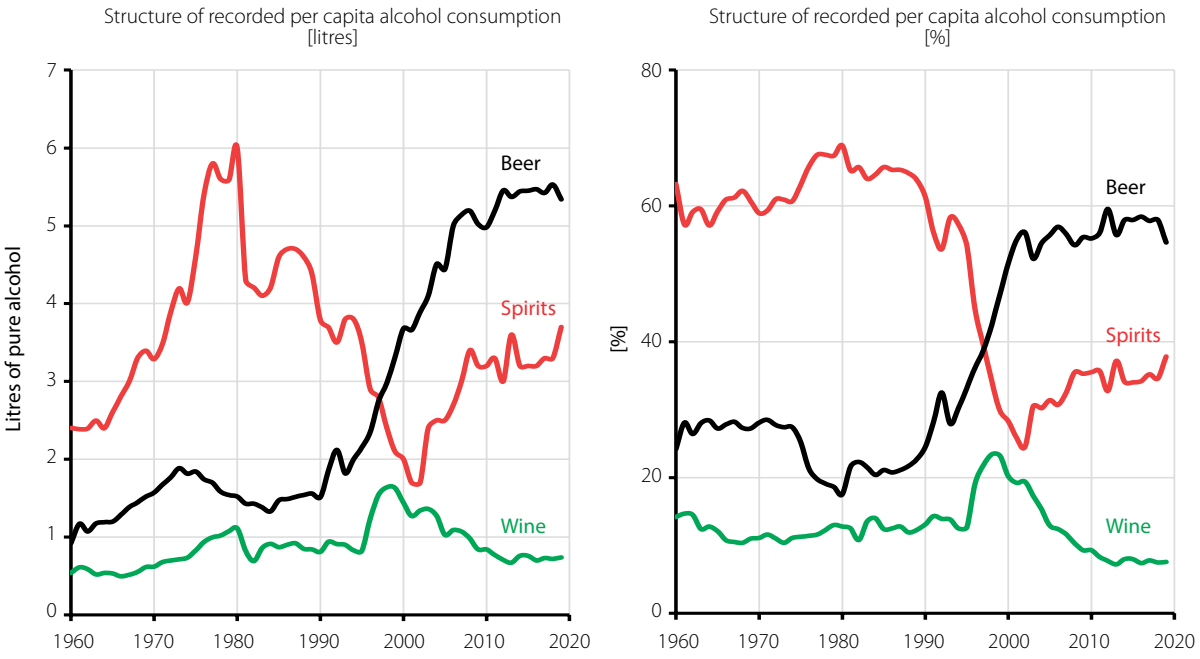

*Data source: http://gapminder.org*

**APPENDIX 2.** Recorded per capita consumption of cigarettes and alcohol, and mortality from lung cancer, cardiovascular disease (CVD), alcohol-attributable cases (AAC) and alcoholic liver cirrhosis (ALC) in Poland, men aged 45-64 years




*CVD – cardiovascular diseases, AAC – alcohol-attributable causes, ALC – alcoholic liver cirrhosis*
*Data source: National Statistical Office and WHO Mortality Database*

**APPENDIX 3.** Recorded per capita (0+) alcohol consumption and structure in Poland, 1960-2019




*Data source: National Statistical Office*