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# The role of epidemiological research in public health using the PURE Poland study as an example

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Epidemiology is a unique science that identifies the incidence and distribution of diseases and their risk factors. An example of response to this need is the “Prospective Epidemiological Study of Urban and Rural Populations” (PURE), conducted in 27 countries around the world, including Poland, which is a unique multi-year cohort study of more than 150,000 people. The purpose of the PURE study is a prospective, multilevel observation of the development of chronic non-communicable diseases and their risk factors. The Polish cohort includes 2036 people from urban and rural areas with a rate response of 88.2% over 15 years.

The main research focus of the analyses of the data collected in the Polish PURE cohort during the multi-year follow-up period was on the incidence and determinants of chronic non-communicable diseases.

The results of the PURE study help in understanding the development of cardiovascular diseases and provide a unique opportunity for research and respond to the need to create guidelines, recommendations, and health policies in line with evidence-based medicine. Its results are compelling evidence pointing to the need to continue to create, develop, and maintain regional and global observational cohorts over many years.

**KEY WORDS:** cohort study, PURE, epidemiology, public health, Poland.

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**INTRODUCTION**

Epidemiology is a unique science that identifies the incidence and distribution of diseases and their risk factors. To develop effective disease control methods, it is necessary to understand how political, social, behavioural, and environmental factors mutually shape the risk of disease development. According to the Centres for Disease Control and Prevention (CDC), the greatest public health achievements of the 20th century, including significant increases in life expectancy, occurred due to epidemiology [1]. Some of the first prospective epidemiological studies, the Framingham Heart Study and the Seven Countries Study, identified cardiovascular disease risk factors and provided a better understanding of CVD prevention. In Poland, despite rapid economic growth

and socioeconomic changes over the past few decades, inequalities in health status and life expectancy are still observed compared to Western European countries. With Poland's accession to the EU in 2004, the HEM project “Closing the gap – Reducing premature mortality baseline for monitoring health evolution following enlargement” was launched, co-financed by the European Commission and led by Prof. Witold Zatonski [2]. The project made it possible to analyse the magnitude and causes of differences in health outcomes between the countries of the eastern part of the European Union (the 10 accession countries of 2004 and 2007) and the western group of the 15 so-called old members of the European Union (EU15). One of the recommendations of the HEM report pointed to the need for observational population-based

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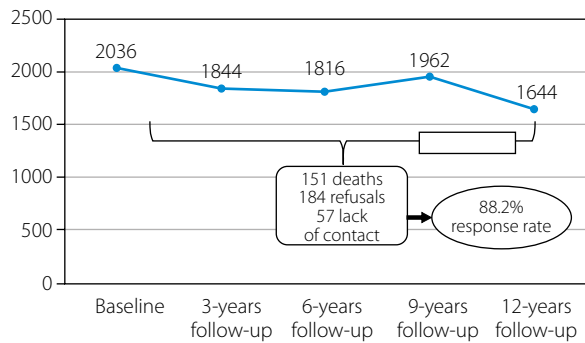


FIGURE 1. PURE Polish cohort over the years (2010-2021)

studies. In the 20th century, Poland lacked prospective cohort studies. In 2007-2010, the Polish cohort of the Prospective Epidemiological Study of Urban and Rural Population (PURE) study was established [3], and in 2009-2011 a cohort within the project entitled “Establishment of infrastructure for the study of the health of the Polish population” (PONS), which allows observation of the study population in terms of the emergence of important health outcomes, such as morbidity and mortality due to cancer, and cardiovascular disease [4]. Since 2016, the PONS project cohort has been included in the global PURE study. To effectively identify bio-psycho-social factors differentiating the incidence of health risks in the study population, an observational cohort, unique in Poland, was established in 2019-2021 as part of the “PICTURE – Population Cohort Study of Wroclaw Citizens – Health Study of School-Age Children (born 2005-2012) and their Guardians” [5]. Prospective cohort studies are a unique source of knowledge about the determinants of health in the populations studied. Scientific evidence gleaned from them provides the basis for taking health-promoting and preventive measures and creating health policies in accordance with evidence-based medicine. The contribution of cohort studies to the development of preventive medicine is invaluable.

### PURE POLAND STUDY DESIGN

PURE is a unique international cohort study conducted in 27 countries around the world, including Poland involving more than 150,000 people. The purpose of the PURE study is the prospective, multilevel observation of the development of chronic non-communicable diseases and their risk factors (including socioeconomic, environmental, behavioural, biological). The PURE study allows both prospective and retrospective assessment of health indicators and thus provides a scientific basis for the development of prevention programs and their evaluation. The originator and leader of the global PURE is Prof. Salim Yusuf of McMaster University in Canada.

At Wroclaw Medical University, a cohort of 2036 people between the ages of 35 and 70 years, permanently residing in Wroclaw and the surrounding areas (urban and

rural population), was formed between 2007 and 2010 [3]. Sixty-three per cent of the respondents were women. Urban residents made up 59% of the cohort. The PURE study protocol includes extensive questionnaire surveys (family status questionnaire, household questionnaire, individual questionnaire, semi-quantitative food frequency questionnaire, International Physical Activity Questionnaire [IPAQ]), anthropometric measurements (height, weight, body mass composition), blood tests (complete blood count, lipidogram: total cholesterol, HDL, LDL, TG; glucose, HbA<sub>1c</sub>, TSH, creatinine, electrolytes: Na, K) and a general urine test, blood pressure measurements, hand grip strength measurement, spirometry, and ECG. In addition, 10 ml of blood is biobanked.

### MULTI-YEAR FOLLOW-UP

Participants are examined in person at the centres every 3 years, and once a year they are contacted by telephone regarding their current health situation, medical events, and hospitalizations. Currently a 15-year follow-up (2022-2025) is being conducted. The international study is planned for 21 years of follow-up.

The cohort established in 2007-2010 included 2036 participants, while the most recently completed 12-year follow-up conducted during the pandemic period (2019-2021) included 1644 participants. Changes in the number of participants in the cohort at different stages of the study are presented in Figure 1. During the study period, 187 people dropped out of further participation, and 57 people were lost to contact. In addition, 151 people died during the study period (Figure 1). The response rate of the cohort was maintained at 88.2% – an exceptionally high rate considering the number of years of follow-up.

During the study, the following medical events were recorded based on history confirmed by medical records: 79 myocardial infarction, 72 heart failure, 61 angina, 100 atrial fibrillation, 253 cancer, 92 stroke, and 224 cases of diabetes mellitus.

### IMPACT OF THE STUDY

Data collected as part of the Polish PURE cohort formed the basis of numerous publications forming a thematic series focusing on the prevalence of broad non-communicable chronic disease risk factors and an analysis of the health situation and its change during the period of observation to date. For the purposes of the PURE Poland study, the Semi-Quantitative Food Frequency Questionnaire (FFQ) was also developed and validated for the Lower Silesian population, which is an excellent tool for assessing the dietary habits of the Polish population [7].

The main research directions in the analyses of the data collected in the Polish PURE cohort during the long-term follow-up period focused on dietary factors [8-16], the effect of CETP and PLTP protein activity on lipid disorders [17, 18], overweight and obesity [19-22], atti-

tudes toward tobacco smoking [23-26], alcohol consumption [27], sleep [28], quality of life [29], prevalence and determinants of hypertension [30, 31], and carbohydrate metabolism disorders [32-36].

The results of a recent study of the Polish PURE cohort showed there was a 3.5% decrease in current smokers during the analysed period (from 20.2% at the baseline study to 16.7% in the 9-year follow-up) [23], an increase in the prevalence of diabetes from 17.7% at baseline to 28.3% at 6-year follow-up [35]. They also showed a 16.5% increase in the prevalence of arterial hypertension at the 9-year follow-up (from 69.4% at baseline to 85.9% at 9-year follow-up) [31]. In addition, they showed min. that the prevalence of hypertension, diabetes, IFG, and visceral obesity decreased in quartiles of the healthy dietary pattern, while the prevalence of CVD, diabetes, IFG, visceral obesity, obesity, and overweight increased when the diet was more in line with the traditional dietary pattern [8].

The Polish PURE cohort was also the base for other scientific studies obtained under grant applications min:

1) "Covered cerebral ischaemia as an early marker of dementia – retro- and prospective evaluation based on Polish population cohort study", which aimed to detect significant risk factors for the development of dementia and to analyse the severity and significance of hidden cerebral ischaemia using multiparametric magnetic resonance (MR) imaging enabling detailed qualitative and quantitative *in vivo* assessment of vascular changes in the brain. The impact of latent ischaemia on the cognitive function of subjects in different age groups was determined, considering a wide panel of health and environmental factors, as well as retro- and prospective observations [37-39].

2) "Oxylipins signature to monitor the cardiometabolic status and its response to dietary intervention (OXYGENATE)", which aimed to identify and validate the oxylipin profile and its reference values reflecting metabolic status and heralding early progression to metabolic syndrome among participants in the Polish PURE cohort. Comparative determination was performed among selected participants of the French Nutrinet-Sante study. The identified profile of oxylipins found in the metabolic syndrome allows unique characterization of the molecular pathways involved in its development. The results indicate the potential clinical utility of the developed OxyScore in identifying patients at high risk of developing cardiovascular disease [40].

In addition, the Polish PURE study has also formed the basis for the preparation of 6 doctoral dissertations and 2 postdoctoral dissertations.

The papers arising from the global PURE project, in accordance with its purpose, address the prevalence of cardiovascular disease risk factors worldwide. Based on data of the global PURE study, more than 120 papers were published in high-impact journals such as Lancet,

Jama, NEJM, BMJ, and Diabetes Care, among others, and the results were used, among other things, to develop 28 clinical practice guidelines recommended by American and European cardiovascular societies in 2018-2021. The recommendations cited were based on the following paper: Prevention of cardiovascular disease including hypertension in the context of salt intake and macronutrients [41, 42].

## CONCLUSIONS

The PURE study helps to understand the development of cardiovascular disease and provides a unique opportunity for retrospective and prospective population-based research. It responds to the need to create guidelines, recommendations, create health policies in line with evidence-based medicine. Its results are compelling evidence pointing to the need to continue to create, develop, and maintain regional and global observational cohorts over many years.

## DISCLOSURE

The authors report no conflict of interest.

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#### AUTHORS' CONTRIBUTIONS

KZ, KPZ prepared research concept and design of the publication. All authors took part in data collection. KZ, ABR, KPZ analysed and interpreted data. KPZ, ABR prepared the first draft of the article. KZ critically revised it. All authors approved the final text of the publication.