

# Is Evidence Based Public Health a copy of Evidence Based Medicine? – a literature review

(Czy Evidence Based Public Health jest kopią Evidence Based Medicine? – przegląd piśmiennictwa)

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**Abstract** – Evidence-based Medicine is defined as the integration of individual clinical expertise and the best available external clinical evidence from systematic reviews. Evidence-based Public Health is described as the development, implementation, and evaluation of effective programmes and health policy by following the principles of proper use of scientific knowledge. It is worth emphasising that while medical data are more often structured, information underlying Public Health is more dynamic and requires far more flexibility. All techniques related to data analysis and visualisation prove to be effective mainly in Public Health. The present study aims to compare both concepts and find differences between sources of information, its availability and time taken to obtain relevant information. The article also presents methods for visualisation of data and software most commonly used for this purpose.

**Key words** - evidence-based medicine, evidence-based public health, comparison, source of information, visualisation of data.

**Streszczenie** – Evidence-based Medicine definiuje się jako integrację indywidualnej wiedzy klinicznej z najlepszymi zewnętrznymi dowodami klinicznymi z przeglądów systematycznych. Evidence-based Public Health opisywane jest jako tworzenie, wdrażanie i ewaluowanie efektywnych programów oraz polityki zdrowotnej, poprzez postępowanie zgodnie z zasadami właściwego wykorzystywania wiedzy naukowej. Wartym podkreślenia jest fakt, że dane z obszaru medycy, częściej mają formę ustrukturyzowaną. Natomiast informacje, na których bazuje zdrowie publiczne, charakteryzują się większą dynamiką i wymagają znacznie bardziej elastycznego podejścia. To głównie w zdrowiu publicznym, sprawdzą się wszelkie techniki związane z analizowaniem danych oraz ich wizualizacją. Niniejsza praca ma na celu zestawienie ze sobą obu koncepcji i wykazanie różnic pomiędzy źródłami informacji, ich dostępnością oraz czasem, w jakim są pozyskiwane. W artykule przedstawione zostaną również metody wizualizacji danych oraz najczęściej używane do tego celu oprogramowanie.

**Słowa kluczowe** – evidence-based medicine, evidence-based public health, porównanie, źródła informacji, wizualizacja danych.

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- A. The idea and the planning of the study
- B. Gathering and listing data
- C. The data analysis and interpretation
- D. Writing the article
- E. Critical review of the article
- F. Final approval of the article

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## I. INTRODUCTION

**E**vidence-based Medicine (EBM), i.e. medicine based on scientific evidence, constitutes a careful, clear, and reasonable use of the best available evidence in decision-making process related to patient care. The practice of Evidence-

based Medicine is defined as the integration of individual clinical expertise and the best available external clinical evidence from systematic reviews [1]. One of the definitions of Evidence-based Public Health (EBPH) describes it as the development, implementation, and evaluation of effective programmes and health policy by following the principles of proper use of scientific knowledge, data, and IT systems [9].

The present paper aims to compare the concepts of *Evidence-based Medicine* (EBM) and *Evidence-based Public Health* (EBPH). In the case of the latter, the attention was drawn mostly to aspects related to possibilities of individual work based on available data. The aspects related to making decisions based on databases and using elements of graphical visualisation of data in everyday practice of a public health specialist were discussed. It seems important to point out the differences between the sources of data, their availability, and time taken to obtain information. It was also discussed whether, in the case of both fields, evidence, once adopted, may be regarded as permanently valid.

## II. EVIDENCE-BASED MEDICINE

### *History of the concept*

Professor David Sackett is recognised as the father of modern evidence-based medicine. At the beginning of his scientific career, Sackett became fascinated with a combination of Public Health and Medicine, which was later referred to as Clinical Epidemiology.

Drummond Rennie, an editor of "*The New England Journal of Medicine*" was another person interested in a similar approach. In 1977 a meta-analysis by Thomas Chalmers landed on his desk. It was the first meta-analysis Rennie had ever seen and he was impressed with the methodology, logic, and clarity of the solutions in terms of his own experience in clinical practice. He also pointed to the fact that the results had been supported by evidence such as studies conducted with appropriate sampling, which had made the results reliable [2].

The present tasks of *Evidence-based medicine* have evolved over time. Gordon Guyatt found that the method and objective of teaching EBM need to be changed. At the beginning it was assumed that after completing a series of trainings in this particular field, a resident should be able to perform a medical examination independently, evaluate and interpret its results taking into account the results of other tests or meta-analyses. However, it often turned out that most graduates were not able to do this. Therefore, it was decided that teaching EBM should aim at gaining knowledge of the key principles that make evidence reliable

or not as well as acquiring skills of finding information on your own.

The authors of the original idea believed that the problem of transferring credibility of evidence over authorities is crucial. The present approach focuses mostly on verification of information, not only on the basis of an established position of the author or journal where the information has been published.

The speed of action in preparation of meta-analyses and systematic reviews is of equal importance. At present, preparation of one systematic review takes approximately two years. The objective should be to reduce the time needed to two weeks, two days, or even two minutes. In order to integrate and systematise all scientific literature, investments should also be made in funds as well as in technology, human resources and knowledge [3].

### *Sources of knowledge*

Contemporary sources of knowledge underlying the concept of *Evidence-based medicine* most often include PubMed, MEDLINE, and Cochrane Library.

### **PubMed**

PubMed is a website comprising references to more than 25 million citations for biomedical literature from MEDLINE, life science journals, and online books. It covers biomedicine and health as well as human, behavioural and chemical sciences, and bioengineering. PubMed is made freely available and maintained by the National Center for Biotechnology Information (NCBI) at the U.S. National Library of Medicine, which is a part of the United States National Institutes of Health. Journal publishers may add abstracts of their articles to the NCBI resources and allow access to full texts of the articles on their websites. PubMed resources include nearly 70 subject-related databases. Selected examples were described below [4]:

- Bookshelf - a collection of biomedical books that can be searched directly or from linked data in other NCBI databases. The collection includes biomedical textbooks, other scientific titles, genetic resources such as GeneReviews, and NCBI help manuals.
- Computational Resources from NCBI's Structure Group - a centralized page providing access and links to resources developed by the NCBI Computational Biology Branch (CBB). These resources cover databases and tools to help in the study of macromolecular structures, classification of protein and small molecules as well as their biological activity.
- Epigenomics - it allows users to browse and visualise sets of epigenomic data. It provides a unique inter-

face for searching and navigating data in relation to biological information of samples, as well as offers tools for downloading and displaying numerous sets of epigenomic data.

- Genome - contains sequence and map data from the whole genomes of over 1,000 organisms. It provides data on completely sequenced organisms and those for which sequencing is in progress. The data concern bacteria, archaea, and eukaryota, as well as many viruses, bacteriophages, plasmids, viroids, and organelles.
- Probe - a public registry of nucleic acid reagents designed for use in a wide variety of biomedical research applications, together with information on probe effectiveness, reagent distributors, and computed sequence similarities.
- PubMed Central (PMC) - a digital archive of full-text biomedical and life sciences journal literature, including clinical medicine and public health.
- SARS CoV - a summary of data for the SARS coronavirus (CoV), including links to the most recent sequence data and publications. It also contains links to other SARS related resources, and a pre-computed alignment of genome sequences from various isolates.

### III. MEDLINE

MEDLINE is an Internet database collecting information on resources of the U.S. National Library of Medicine (NLM), containing more than 22 million references to biomedical and life sciences journal articles. It is typical of MEDLINE that all database records are indexed with MeSH (MeSH - metadata system aiming at indexing medical articles and books). MeSH records are listed both alphabetically and hierarchically. In 2016, MeSH contained 27,883 descriptors and 87,000 key words helping to provide the most relevant search results [5].

#### Cochrane Collaboration

Cochrane Collaboration is an organisation working for better choices regarding protection of health and continuation of a long standing activity that helped to change the attitude towards doctor's practice over time. Cochrane collects and analyses results of the best research to facilitate decision-making processes in diagnosis and treatment. It is an independent group of scientists, doctors, patients, caretakers, and persons interested in health care issues.

Cochrane works collaboratively with partners from over 120 countries to produce reliable and available infor-

mation on health-related issues. A number of Cochrane's contributors are world leaders in their fields such as medicine, health policy, methodology of research, and consumer case-law. It is believed that the work performed by Cochrane represents a gold standard of high quality and reliability of information.

Cochrane does not have one main office. Both the contributors and expert groups are based all around the world and most of the work and communication are done online. Each group is a 'mini-organization' in itself, with its own funding, website, and workload.

Cochrane does not accept commercial or conflicted funding. According to Cochrane, freedom to work unconstrained by commercial and financial interests is vital for generating sound and reliable information [6].

#### A. Measures for assessment of information and its availability

The way information is selected and assessed is crucial in terms of gaining evidence-based knowledge. The Evidence-based Medicine Pyramid (Fig. 1) is the basic scheme allowing for systematisation of scientific evidence by the hierarchy of reliability and importance.

The pyramid was developed to help understand the importance of various levels of evidence in terms of making health related decisions. It also allows for comparing results of each project with other results by taking into account its strengths and weaknesses. The pyramid is divided into levels representing types of research that meet rising quality and reliability standards of evidence in ascending order. In other words, information at the top of the pyramid provides greater certainty about the accuracy of results, lower risk of statistical error, and minimum deviation from confounding variables affecting the results [7].

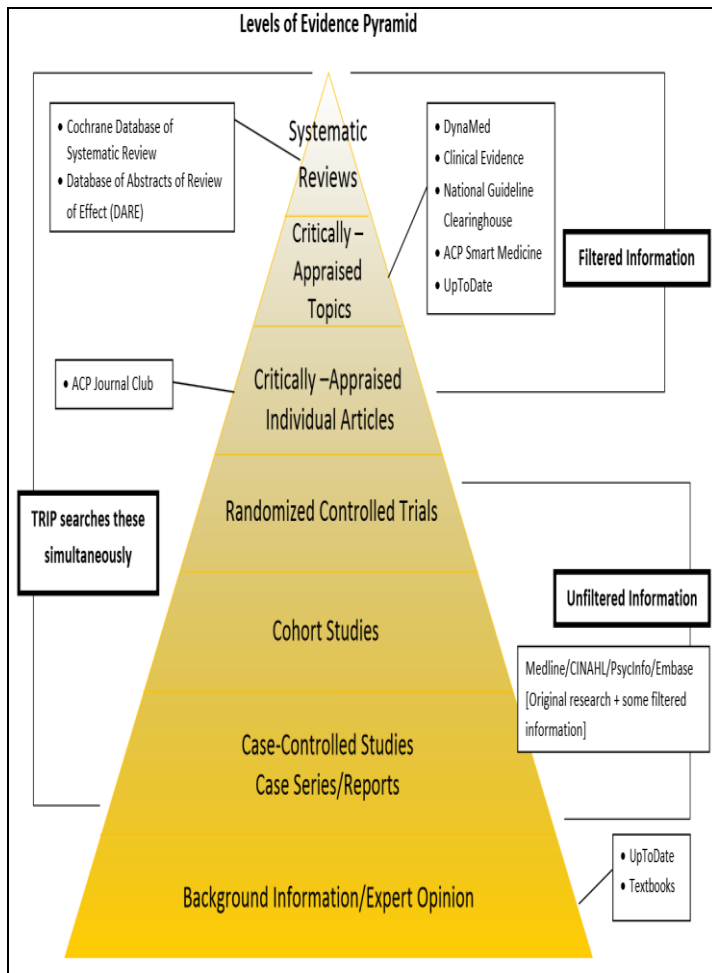


Figure. 1 Pyramid presenting the significance of studies being the material for evidence-based medicine [7]

Starting from the top of the pyramid, i.e. top quality studies, particular levels include the following:

- Systematic reviews
- Critically-appraised topics and articles
- Randomized controlled trials (RCT)
- Cohort studies
- Case-controlled studies, case series/reports
- Single-case studies and expert opinion

### Evidence-based Public Health

There have been significant achievements in modern Public Health. A large part of the growth can be attributed to the enforcement of standards related to vaccination, water and food security, wastewater treatment, prevention of tobacco use, and prevention of injury. Despite certain achievements, Public Health still faces a number of challenges. In order to respond to those challenges it is necessary to undertake further relevant evidence-based initiatives [10].

When making management decisions, developing strategies and implementing projects related to health promotion Public Health specialists should always rely on evidence. However, decisions are usually based on short-term needs. Equally often, unverified information are used for policy development [11].

### Sources of knowledge

Considering that public health, healthcare and persons responsible for healthcare policy need ongoing access to independent and reliable information for decision-making, Health Evidence Network was initiated by the World Health Organisation Regional Office for Europe in 2003. It is a platform providing information as evidence in multiple formats that accelerate and improve decision-making.

A large amount of information and evidence available in the area of public health is dispersed among numerous databases. HEN facilitates access to many of them in a single website. In the context of its activities, HEN also produces its own publications that are grouped in three main categories:

- reports on information about a particular subject, addressed mostly to health policy makers;
- policy briefs worked out in cooperation with the European Observatory on Health Systems and Policies, which aim to select information on specific policy options for solving key health system issues;
- HEN summaries of reports, including synopses of the key findings and arrangements.

Health Evidence Network has access to specialists across the region who provide advice and support. It is important that HEN sources of information are precisely classified with regard to the field of knowledge they serve. Each source is described in terms of its content, availability of information, type of information, addressee, and language of publication. The following organisations were included in the HEN list [12]:

- Aggressive Research Intelligence Facility (ARIF) - a cooperation between departments at the University of Birmingham aiming to implement standards for evidence-based decision-making in health care at the population level [13];
- Andalusian Agency for Health Technology Assessment – aiming to support health care decision-makers by searching and providing scientific information as well as evaluating projects carried out so far [14];
- Banque de Données Santé Publique (BDSP) - a network established by the French government; it veri-

fies and provides access to information crucial for public health. The network is mainly interested in the following areas: population health, assessment of external influences on health, evaluation of public health programmes and analysis of research in all other fields that contribute to public health [15].

- Basque Office for Health Technology (OSTEBA) - an organisation established in 1992 by the Basque Government, Spain aiming to promote the proper use of health technology in terms of safety, effectiveness, accessibility and equity. OSTEBA is a member of the International Network of Agencies for Health Technology Assessment [16].
  - Belgian Health Care Knowledge Centre (KCE) - an independent institution established by the Belgian government as a centre providing analysis and reports to support decision-making. Studies cover the following areas: good clinical practice, health technology assessment and health services research [17].
  - Catalan Agency for Health Information, Assessment and Quality (CAHIAQ) - a public agency of the region of Catalonia. Its mission is to summarise relevant knowledge for supporting quality, safety and sustainability of the Catalan health care system. In addition, it is responsible for assessment of health technology and evaluation of health care activities [18].
  - Centre for Reviews and Dissemination (CRD) - it is a part of the National Institute for Health Research and constitutes a research department of the University of York, England. It was established in 1994 to provide research-based information on initiatives related to health care and social protection. CDR runs three databases: Database of Abstracts of Reviews of Effects (DARE), NHS Economic Evaluation Database (NHSEED), and HTA database. It also manages the PROSPERO database – an international database of registered systematic reviews relevant to health and social care [19].
  - Cochrane Collaboration - an international non-profit network associating professionals and scientists from over 100 countries to support a wide range of decision-makers as well as patients and their representatives in making informed decisions based upon the best available evidence. It disseminates and promotes the access to systematic reviews and studies on health and health policy [6].
  - Council of Europe (COE) - an international governmental organisation comprising 47 member states. It deals with the protection of human rights, democra-
- cy, and the rule of law. COE works on solutions to modern problems facing European countries, like racial discrimination, xenophobia, intolerance, environmental protection, organised crime, and drug-related problems. It encourages the development of cultural identity and variety in Europe. COE provides access to various reports, publications, newsletters, bulletins, expert opinions and press articles [20].
  - Database of Abstracts of Reviews of Effects (DARE) - a database managed by the University of York, England comprises summaries of systematic reviews focusing mostly on evaluation of the effects of healthcare services. DARE contains reviews concerning determinants of health, such as place of residence, means of transport, and social care [21].
  - European Centre for Disease Prevention and Control (ECDC) - an European Union agency aiming at prevention of communicable diseases in the territory of the EU. ECDC identifies, evaluates and implements procedures for treatment and prevention of diseases, in accordance with the current threats. It works together with national health institutions to monitor the epidemiological situation in Europe. In addition, it sustains early warning system and works with experts across Europe in order to provide a rapid and adequate response to threats related to the spread of infectious diseases [22].
  - European Commission Directorate-General for Health and Consumers (DG SANCO) - commission established in 1999 to improve the quality of life in the European Union by implementing relevant policy, provisions of law and programmes within three major areas: public health, empowerment of consumers, and maintenance of a high level of food safety [23].
  - European Environment Agency (EEA) - EEA is a EU agency comprising 33 member states. Its key task is to provide decision-makers with information necessary for sound and effective policy in environmental protection and sustainability. In addition, EEA coordinates the European Environment Information and Observation Network (Eionet) [24].
  - European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) - established in 1993 to provide EU member states with updated knowledge of European drug problems. EMCDDA offers policymakers the necessary scientific evidence for developing drug laws and strategies. In addition, it helps profes-

sionals and scientists identify the best practice and new areas of research [25].

- European Observatory on Health Systems and Policies - supports and promotes evidence-based health policy-making through comprehensive analysis of the dynamics of European health care systems. It is committed to international cooperation to provide detailed description of health care systems and changes therein as well as to communicate problems in health policy. It collaborates with a number of scientists, decision-makers, and practitioners [26].
- Finnish Office for Health Technology Assessment (Finohta) - established in 1995 to promote effectiveness of Finnish health care system by responding to questions concerning the efficacy, safety, costs, and other issues of health technologies in the form of reports for the Finnish Ministry of Health [27].
- French Institute for Public Health Surveillance (InVS) - a governmental institution reporting to the French Ministry of Health. InVS is responsible for supervision and alarming in all areas of public health: infectious diseases, environmental diseases, occupational risks, chronic diseases, and injuries. Its activity includes monitoring of population health as well as supervision of health risk and health warnings [28].
- German Agency for Health Technology Assessment (DAHTA@DIMDI) - is a part of the German Institute of Medical Documentation and Information, which is a part of German Federal Ministry of Health. It provides reports on medical, economical, social, ethical, and legal issues related to German health care system. It also manages a database comprising its own HTA reports as well as national and international reports published by other organisations. Since the beginning of 2012, it has also managed the International Network of Agencies for Health Technology Assessment (INAHTA) [29].
- Haute Autorité de Santé (HAS) - an independent public authority established by the French government in 2004. It works for improving the quality of patient care and ensuring equal access to health care system. In addition, its activities include assessment of drugs and medical devices as well as accreditation and certification of physicians [30].
- Health Council of the Netherlands (Gezondheidsraad) - an independent scientific advisory body of the Dutch government and Parliament on public health and healthcare. It deals with health and healthcare, treatment and prophylaxis as well as nutrition and environmental protection [31].
- Health Technology Assessment Programme, National Institute for Health Research - a programme developed at the University of Southampton, England. It conducts research on cost-effectiveness and efficacy of activities performed within the health care system. It also provides information on opportunities of funding for research and engagement of national and international organisations [32].
- Healthcare Improvement Scotland - a health care authority set up to support the Scottish Ministry of Health and independent healthcare providers in providing patients with safe and efficient care [33].
- International Agency for Research on Cancer (IARC) - a part of the World Health Organisation, a UN Specialised Agency. It coordinates and conducts research on causes of cancer in people and mechanisms of carcinogenesis as well as it develops scientific strategies for cancer control. The Agency is engaged in epidemiological and laboratory studies as well as dissemination of scientific information, publications, information on meetings, courses and fellowships [34].
- International Network of Agencies for Health Technology Assessment (INAHTA) - serves as a forum for 57 agencies for health technology assessment from 32 countries of the world. A large database includes up-to-date projects and publications [35].
- Joint United Nations Programme on HIV/AIDS (UNAIDS) - as a strong supporter of global action for HIV/AIDS, it carries out a broad initiative aiming at HIV prevention, ensuring care and support, reducing vulnerability of individuals and communities to HIV/AIDS, and mitigating the impact of epidemic. It is a key player in management and dissemination of knowledge and information about HIV infections and development of global immunity to HIV. The main programme areas cover monitoring and assessment, mobilisation and tracking of resources, political and technical advice, as well as development of partnership with civil society and private sector [36].
- National Institute for Health and Care Excellence (NICE) - an independent organisation responsible for editing national guidelines related to health promotion, prophylaxis, and treatment [37].
- National Institute for Public Health and the Environment (RIVM) - conducts research on environmental protection and public health in the Netherlands. Its analyses are used for the development, implementa-

tion, and enforcement of health and environmental policies [38].

- Norwegian Knowledge Centre for the Health Services (NOKC) - an independent non-governmental organisation reporting to the Norwegian Ministry of Health. It gathers and disseminates evidence associated with the effects and quality of methods and interventions used in all sectors of healthcare system [39].
- Organisation for Economic Co-operation and Development (OECD) - OECD is an international organisation comprising 34 countries, established in 1961 to stimulate the economic development and world trade. It encourages sustainable economic growth in all member states participating in the development process [40].
- Public Health Agency of Sweden - National Centre established by the Swedish Ministry of Health and Social Affairs to develop and promote measures and strategies for action concerning public health. The Agency is responsible for a complex, intersectoral observation and assessment of national public health policy as well as alcohol, drug, and tobacco policies [41].
- School of Health and Related Research (ScHARR) - a school that is subject to the University of Sheffield, England, divided into three sections: public health, health services research, as well as health economics and decision-making. The second field represents the greatest activity, with its major theme being the evaluation with the use of methodology derived from medicine, nursing, and other related medical professions and social sciences [42].
- Scientific Institute of Public Health - a federal office of the Belgian State. Its basic tasks include providing professional and scientific support for health policy as well as providing knowledge and services related to public health [43].
- Swedish Council on Technology Assessment in Health Care (SBU) - an independent governmental agency promoting efficient use of public health resources in Sweden. It evaluates clinical, economic, social, and ethical implications of existing and new health technologies. In addition, it synthesises data and disseminates its own assessments, and thus promotes the efficient and effective development of high-quality healthcare [44].
- United Nations Children's Fund (UNICEF) - a part of the UN entitled to act for the protection of the rights of children in order to secure their fundamental

needs and improve their opportunities. UNICEF works in more than 190 countries and regions within the framework of national programmes and national committees [45].

- United Nations Development Programme (UNDP) - acts as a global network for the UN development system. It allows for an international exchange of experience, knowledge, and resources to help people build a better life. UNDP focuses on the fight against poverty, building democratic societies, crisis prevention, allowing treatment, environmental protection, HIV/AIDS prevention, empowering women, and nurturing national capacities [46].
- United Nations Population Fund (UNFPA) - this international agency for development works in 150 countries in order to promote the rights of every man, woman, and child so that they could enjoy a healthy life and have equal opportunities for personal development. UNFPA supports developing countries to improve availability and quality of the protection of reproductive health, particularly family planning, safe motherhood, and prevention of sexually transmitted diseases, including HIV/AIDS [47].
- WHO Regional Office for Europe (WHO/Europe) - one of WHO's six regional offices whose main responsibility is to take efforts to address health problems and public health problems across the world. WHO/Europe assists 53 countries in the European Region in developing health policy, health care systems and public health programmes, aiming at improving health, reducing health inequalities and strengthening international solidarity for health [12].
- World Bank (WB) - this specialised UN agency provides development assistance by offering loans and credits, while focusing on the achievement of the Millennium Development Goals for sustainable poverty reduction [48].

#### B. Useful software

Each institution, company or a single individual who wishes to start working on the basis of their data or resources available on the Internet will face the problem of choosing appropriate software. A yearly report published by Gartner that provides, among others, assessment and advice on the best practices in the IT sector can be helpful. The Gartner *Magic Quadrant for Business Intelligence and Analytics Platforms* report [49] analyses advantages and disadvantages of BI platforms available on the market and describes each of them in terms of standardised criteria. Gartner named Tableau Software a leader in its report for

2006. Tableau offers highly interactive and intuitive products which provide business users with easy access, preparation and analysis of data without the need of coding. According to Gartner, the strongest advantage of Tableau's application includes its universality in terms of possibility of implementing it either to the entire IT structure or to a single post. It is of greatest benefit due to various data policies adopted in particular organisations. While implementing the software, analyses may be performed both at the central level and at the level of a single team, which makes it the most flexible solution in this area. Its weaknesses include, first and foremost, the price and certain limitations related to the interconnection of different types of databases. Tableau Software is a tool that can largely influence the overall performance of working with data and cut down significantly the time necessary for analysing databases [50].

#### *Modern data visualisation in practice*

Researchers often consider whether it is possible to analyse data before they are even collected. Help should be provided by tools allowing for a quick aggregation of data and presentation of the most significant parameters in an accessible way. Traditional spreadsheets are relatively slow and possibility of continuous reporting is quite limited.

Practical examples of using "business intelligence" (BI) software in health care on the basis of a randomly selected application from the Gartner's report are presented below [50].

BI software provides a visualisation of costs, needs and results at the same time allowing for choosing the best way of using available resources. It helps hospitals identify the impact of *Evidence-based Medicine*, health promotion programmes, and patient engagement. It enables government and non-government payers to understand factors influencing certain trends to make better decisions and plan more viable long-term strategies. BI systems may also prove helpful for patients in choosing the right care [51].

The first example of using the system concerns the patient volume of a healthcare unit with reference to a day of the week, hour, specialisation, wait time and satisfaction of patients. Since the visualisation at this stage is interactive, an overview of data is possible at every angle: starting from the choice of a healthcare unit, through time slots and type of data to information on a single patient. This kind of an overview of data may be helpful in decision-making about employing specialised doctors. The emergency department may serve as an example: its patient volume grows in proportion to the time of the day, which suggests that it would be advisable to increase the number of the personnel at certain times of a day. In the case of other hospital depart-

ments, the patient volume is much more even, thus a change in the number of the personnel during the day is not justified [52].

Aggregation of data related to the costs of hospital services in Florida is the second example. The available visualisation responds to a number of questions associated with hospital economics. It is possible to filter data by region or particular procedures to view information on the costs in particular hospitals [53].

The third example shows the efficiency of a healthcare unit in terms of patient service in certain areas on the way from entering to leaving the healthcare unit:

- Wait at check-in;
- Wait in waiting room;
- Complete check-in;
- Move to exam room;
- Wait for physician;
- Interact with physician;
- Move to checkout;
- Wait at checkout and checkout.

The available visualisation shows wait time of patients over two months in a multi-physician office. Check-in improvements were implemented on week 4 to reduce wait time. Charts presented in the report demonstrate a significant reduction of average wait time after the introduction of changes [54].

#### *Similarities and differences between EBPH and EBM*

The concept of *Evidence-based Medicine* consists in developing the best available therapy for a particular patient on the basis of collecting all the best scientific evidence in pathophysiology, cost efficiency, and patient preferences. Certain skills are needed for adopting EBM, such as tracking down the evidence, critical assessment and quick comparison of information from many sources as well as implementation of these data into clinical practice.

Choosing the best solution out of a set of rational alternatives is the most cost-effective approach towards the issues of public health as far as EBPH is concerned. This refers to a number of areas of public health such as epidemiology, biostatistics, behavioural science, health economics, and management in healthcare. Applying this concept also needs to be time-effective [10].

Significant differences found between both approaches discussed in the present paper concern the quality and quantity of evidence. Research into medicinal products or new therapeutic methods are mostly based on randomized control trials. Most interventions in public health rely on estimated pseudo-experimental data that are not tailored to



the target group, which may affect the quality of evidence. The time from the beginning of a study to obtaining results undoubtedly constitutes another important difference. For instance, action for tobacco control significantly reduced the incidence rate of lung cancer, but it was necessary to wait several decades for the final effects of smoke-free policy. The fact that the training of specialists in public health is much more diverse than the one of physicians constitutes the last significant difference between the two approaches. Public health refers to numerous fields, which makes it practically impossible to develop a certification system for professionals in this specialty. See Table 1 for differences in the areas of interest and research between medicine and public health.

Table 1. Differences between Evidence-based Medicine and Evidence-based Public Health

Medicine	Public health
Single-patient oriented approach	Population-oriented approach
Ethics of personal care, determined by awareness of social responsibility	Ethics of public service with a view to individual persons
Emphasis put on diagnosis, treatment, and care	Emphasis put on prophylaxis, promotion of health with reference to both a patient and society
Medical paradigm places special emphasis on healthcare	Public health paradigm engages a series of actions focused on the environment, human behaviour, lifestyle, and healthcare
One profession known and defined in society	Different professions whose roles are not defined in society and with non-uniform image
One established certification process for health professionals	Different certification processes for professionals in various areas of public health
Organised specialisations, e.g. according to:	Organised specialisations, e.g. according to:
Groups of body organs (e.g. cardiology) <ul style="list-style-type: none"> <li>• Groups of patients (e.g. paediatrics)</li> <li>• Aetiology, pathophysiology (e.g. oncology, infectious diseases)</li> <li>• Technology (e.g. radiology)</li> </ul>	Analytical methods (e.g. epidemiology) <ul style="list-style-type: none"> <li>• Action for specific population (e.g. healthy working environment)</li> <li>• Problem being the source of disease (e.g. nutrition)</li> </ul>
Biological sciences as the source from the point of view of the needs of patients	Biological sciences as the source from the point of view of population health risks
Mathematical sciences are gaining importance, although they constitute a relatively small part of the field	Mathematical sciences constitute a substantial part of the analysis
Social sciences seem to be an optional part of medical education	Social sciences are an integral part of public health education
Clinical sciences are a significant part of vocational training	Clinical sciences are a secondary part of vocational training

#### IV. CONCLUSION

The present paper demonstrated differences between the data sets of *Evidence-based Medicine* and *Evidence-based Public Health*. It is worth emphasising that while medical data are more often structured, information underlying public health is more dynamic and requires far more flexibility. All techniques related to data analysis and visualisation prove to be effective mainly in public health. Public health will increasingly involve skills to compare information from numerous fields and base the decision-making processes on correlations between them.

The answer to the question included in the title of the paper is that *Evidence-based Public Health* is not a copy of *Evidence-based Medicine*. Public health and health promotion measures largely depend on the acceptance of the environment they are to be taken in. Cultural, religious, demographic, and economic factors as well as those associated with the education level of the target group are considered, among others. Analysis of the above allows for the conclusion that there are no two communities on a global scale that would be similar to each other to such an extent that it would be possible to take an identical healthcare campaign from one country to another and obtain similar outcomes. However, in the case of *Evidence-based Medicine*, it is very likely that a treatment that is effective in one group of patients will produce similar effects in another one.

It can also be considered that readily available tools for data analysis are good at dealing with past information and are getting better at real-time analysis. However, the next stage, e.g. capacity of anticipating upcoming events, constitutes even larger scope for action in the healthcare system. This will also open up a great number of new opportunities for public health.

#### V. REFERENCES

- [1] New York University Health Sciences Library [World Wide Web]. eml; c2016 [cited 2016 Dec 12]. Available from: <https://library.med.nyu.edu>.
- [2] The Journal of the American Medical Association [World Wide Web]. c2016 [cited 2016 Dec 29]. Available from: <http://ebm.jamanetwork.com>.
- [3] Smith R. Evidence-Based Medicine—An Oral History. JAMA 2014; 311(4): 365-367.
- [4] National Center for Biotechnology Information [World Wide Web]. ncbi; c2016 [cited 2016 Dec 30]. Available from: <http://www.ncbi.nlm.nih.gov>.
- [5] U.S. National Library of Medicine [World Wide Web]. medline; c2016 [cited 2016 Dec 24]. Available from: <https://www.nlm.nih.gov>.

- [6] Cochrane Collaboration [World Wide Web]. cc; c2016 [cited 2016 Dec 30]. Available from: <https://www.cochrane.org>.
- [7] Minkow D. The Evidence-Based Medicine Pyramid! Students 4 best evidence.2014. [World Wide Web]. c2016 [cited 2016 Dec 30]. Available from: <http://www.students4bestevidence.net>.
- [8] Dartmouth Biomedical Libraries [World Wide Web]; dml; c2017 [cited 2017 Jan 5]. Available from: <http://www.dartmouth.edu/~biomed/institute2011/directio ns.html>.
- [9] Brownson, R, Baker E, Lett T. Evidence-Based Public Health (2 ed.). New York; Oxford University Press Inc., 2011.
- [10] Brownson R C. Evidence-Based Decision Making in Public Health. EOC Pub Health Prin Pract 1999; 5; 85-97.
- [11] Davidovitch N, Filc D. Reconstructing data: Evidence-Based, Acta Hisp Med Sci Hist Illus 2006; 26;287-306.
- [12] World Health Organization [World Wide Web]. who; c2017 [cited 2017 Jan 5]. Available from: <http://www.euro.who.int>.
- [13] Univeristy of Birmingham [World Wide Web]. arif; c2017 [cited 2017 Jan 5]. Available from: <http://www.birmingham.ac.uk>.
- [14] Andalusian Agency for Health Technology Assessment [World Wide Web]. aetsa; c2017 [cited 2017 Jan 5]. Available from: [www.inahta.org/members/aetsa](http://www.inahta.org/members/aetsa).
- [15] Banque de Données Santé Publique [World Wide Web]. bdsp; c2017 [cited 2017 Jan 5]. Available from: <http://www.bdsp.ehesp.fr>.
- [16] Basque Office for Health Technology [World Wide Web]. osteba; c2017 [cited 2017 Jan 5]. Available from: [www.inahta.org](http://www.inahta.org).
- [17] Belgian Health Care Knowledge Centre [World Wide Web]. kce; c2017 [cited 2017 Jan 5]. Available from: <https://kce.fgov.be>.
- [18] World Health Organization [World Wide Web]. who; c2017 [cited 2017 Jan 5]. Available from: <http://data.euro.who.int/HEN/Search/SearchResult.aspx?SourceEvidenceId=6>.
- [19] Univerity of York [World Wide Web]. crd; c2017 [cited 2017 Jan 5]. Available from: <http://www.york.ac.uk/crd>.
- [20] Council of Europe [World Wide Web]. coe; c2017 [cited 2017 Jan 5]. Available from: <http://www.coe.int/en>.
- [21] Database of Abstracts of Reviews of Effects [World Wide Web]. dare; c2017 [cited 2017 Jan 5]. Available from: <https://www.ncbi.nlm.nih.gov/pubmedhealth/about/DARE>.
- [22] European Centre for Disease Prevention and Control [World Wide Web]. ecdc; c2017 [cited 2017 Jan 5]. Available from: <http://www.ecdc.europa.eu>.
- [23] European Commission Directorate-General for Health and Consumers [World Wide Web]. dgsanco; c2017 [cited 2017 Jan 5]. Available from: [http://ec.europa.eu/dgs/health\\_food-safety/index\\_en.htm](http://ec.europa.eu/dgs/health_food-safety/index_en.htm).
- [24] European Environment Agency [World Wide Web]. eea; c2017 [cited 2017 Jan 5]. Available from: <http://www.eea.europa.eu>.
- [25] European Monitoring Centre for Drugs and Drug Addiction [World Wide Web]. emcdda; c2017 [cited 2017 Jan 5]. Available from: <http://www.emcdda.europa.eu>.
- [26] European Observatory on Health Systems and Policies [World Wide Web]. c2017 [cited 2017 Jan 5]. Available from: <http://www.euro.who.int/en/about-us/partners/observatory>.
- [27] Finnish Office for Health Technology Assessment [World Wide Web]. finohta; c2017 [cited 2017 Jan 5]. Available from: [www.inahta.org/members/finohta](http://www.inahta.org/members/finohta).
- [28] French Institute for Public Health Surveillance [World Wide Web]. invs; c2017 [cited 2017 Jan 5]. Available from: <http://invs.santepubliquefrance.fr/en>.
- [29] German Agency for Health Technology Assessment [World Wide Web]. dahta; c2017 [cited 2017 Jan 5]. Available from: <http://www.dimdi.de/static/en/hta/dahta>.
- [30] Haute Autorité de Santé [World Wide Web]. has; c2017 [cited 2017 Jan 5]. Available from: <http://www.has-sante.fr/portail>.
- [31] Health Council of the Netherlands [World Wide Web]. c2017 [cited 2017 Jan 5]. Available from: <https://www.gezondheidsraad.nl/en/home>.
- [32] National Institute for Health Research [World Wide Web]. nhs; c2017 [cited 2017 Jan 5]. Available from: <http://www.nets.nhr.ac.uk/programmes/hta>.
- [33] Healthcare Improvement Scotland [World Wide Web]. c2017 [cited 2017 Jan 5]. Available from: <http://www.healthcareimprovementscotland.org>.
- [34] International Agency for Research on Cancer [World Wide Web]. iarc; c2017 [cited 2017 Jan 5]. Available from: <https://www.iarc.fr>.
- [35] International Network of Agencies for Health Technology Assessment [World Wide Web]. inahta; c2017 [cited 2017 Jan 5]. Available from: [www.inahta.org](http://www.inahta.org).
- [36] Joint United Nations Programme on HIV/AIDS [World Wide Web]. unaids; c2017 [cited 2017 Jan 5]. Available from: <http://www.unaids.org>.
- [37] National Institute for Health and Care Excellence [World Wide Web]. nice; c2017 [cited 2017 Jan 5]. Available from: <https://www.nice.org.uk>.
- [38] National Institute for Public Health and the Environment [World Wide Web]. rivm; c2017 [cited 2017 Jan 5]. Available from: <http://www.rivm.nl/en>.
- [39] Norwegian Knowledge Centre for the Health Services [World Wide Web]. nokk; c2017 [cited 2017 Jan 5]. Available from: [www.inahta.org/members/nokk](http://www.inahta.org/members/nokk).
- [40] Organization for Economic Co-operation and Development [World Wide Web]. oecd; c2017 [cited 2017 Jan 5]. Available from: <https://www.oecd.org>.
- [41] Public Health Agency of Sweden [World Wide Web]. c2017 [cited 2017 Jan 5]. Available from: <https://www.folkhalsomyndigheten.se/the-public-health-agency-of-sweden>.
- [42] The University of Sheffield [World Wide Web]. scharr; c2017 [cited 2017 Jan 5]. Available from: <https://www.sheffield.ac.uk/scharr>.
- [43] Scientific Institute of Public Health [World Wide Web]. c2017 [cited 2017 Jan 5]. Available from: <https://eupha.org/scientific-institute-of-public-health>.
- [44] Swedish Council on Technology Assessment in Health Care [World Wide Web]. sbu; c2017 [cited 2017 Jan 5]. Available from: <http://www.sbu.se/en>.
- [45] United Nations Children's Fund [World Wide Web]. unicef; c2017 [cited 2017 Jan 5]. Available from: <https://www.unicef.org>.
- [46] United Nations Development Programme [World Wide Web]. undp; c2017 [cited 2016 Jan 5]. Available from: <http://www.undp.org>.

- [47] United Nations Population Fund [World Wide Web]. unfpa; c2017 [cited 2017 Jan 5]. Available from: <http://www.unfpa.org>.
- [48] The World Bank [World Wide Web]. wb; c2017 [cited 2017 Jan 5]. Available from: <http://www.worldbank.org>.
- [49] Teach Target [World Wide Web]. c2017 [cited 2017 Jan 8]. Available from: <http://searchdatamanagement.techtargt.com/definition/business-intelligence>.
- [50] Gartner. Magic Quadrant for Business Intelligence and Analytics Platforms [World Wide Web]. c2016 [cited 2016 Dec 15]. Available from: <https://www.gartner.com/doc/reprints?id=1-2XXET8P&ct=160204&st=sb>.
- [51] Tableau Software. Healthcare [World Wide Web]. c2016 [cited 2017 Jan 8]. Available from: <http://www.tableau.com/stories/topic/healthcare>.
- [52] Tableau Software. Explore clinic patient volumes by time of day [World Wide Web]. c2016 [cited 2017 Jan 8]. Available from: <http://www.tableau.com/stories/workbook/improve-patient-satisfaction-improving-cycle-time>.
- [53] Tableau Software. Compare costs of medical procedures by hospital [World Wide Web]. c2016 [cited 2017 Jan 8]. Available from: <http://www.tableau.com/stories/workbook/unified-access-medical-records-and-patient-information>.
- [54] Tableau Software. Track the impact of efforts to reduce patient wait times [World Wide Web]. c2016 [cited 2017 Jan 8]. Available from: <http://www.tableau.com/stories/workbook/keep-track-trends-minimize-costs>.
- [55] Gebbie K, Rosenstock L, Hernandez L. Who Will Keep the Public Healthy? Educating Public Health Professionals for the 21st Century. Washington; The National Academies Press, 2001.