Military Physician

Quarterly

Official Organ of the Section of Military Physicians at the Polish Medical Society

Oficjalny Organ Sekcji Lekarzy Wojskowych Polskiego Towarzystwa Lekarskiego

Scientific Journal of the Military Institute of Health Service

Pismo Naukowe Wojskowego Instytutu Medycznego

Published since 3 January 1920

Number of points assigned by the Polish Ministry of Science and Higher Education (MNiSW) – 6

Editorial Board

Editor-in-Chief

Jerzy Kruszewski

Deputy Editors-in-Chief

Krzysztof Korzeniewski, Marek Maruszyński, Piotr Rapieżko

Secretary

Ewa Jędrzejczak

Editorial Office

Military Institute of Medicine

6 Szaserów St. 04-141 Warsaw 44
telephone/fax: +48 261 817 380
e-mail: lekarzwojskowy@wim.mil.pl

www.lekarzwojskowy.pl

© Copyright by Military Institute of Medicine

Practical Medicine Publishing House / Medycyna Praktyczna

2 Rejtana St. 30-510 Kraków
telephone: +48 12 29 34 020, fax: +48 12 29 34 030
e-mail: listy@mp.pl

Managing Editor

Lidia Miczyńska

Proofreading

Dariusz Rywczak, Iwona Żurek

Cover Design

Krzysztof Gontarski

Typesetting

Łukasz Łukasiewicz

DTP

Katarzyna Opiela

Advertising

Piotr Lorens MD
telephone: +48 663 430 191; e-mail: piotr.lorens@mp.pl

Print

TECHNET, Kraków
Circulation: 700 copies
Price PLN 14
ISSN 0024-0745

Program Council Members

Chairman
Grzegorz Gielearak – Head of the Military Institute of Medicine

Members

Massimo Barozzi (Italy)
Nihad El-Ghoul (Palestine)
Claudia E. Frey (Germany)
Anna Hauska-Jung (Poland)
Stanislaw Ilinski (Poland)
Wieslaw W. Jędrzejczak (Poland)
Dariusz Jurkiewicz (Poland)
Pawel Kaszubski (USA)
Frederick C. Lough (USA)
Marc Montillon (Belgium)
Arnon Nagler (Israel)
Stanislaw Niemczyk (Poland)
Krzysztof Panik (Poland)
Francis J. Ring (UK)
Tomasz Rozmyslawowicz (USA)
Daniel Schneditz (Austria)
Zofia Walfowicz (Poland)
Brenda Wiederhold (USA)
Piotr Zaborowski (Poland)

For many years, "Military Physician" has been indexed in the Polish Medical Bibliography (Polska Bibliografia Lekarska), the oldest Polish bibliography database.

The primary version of "Military Physician" quarterly is its electronic version (www.lekarzwojskowy.pl)

The journal is financed by the Military Medical Chamber

Translation, proofreading and DTP of the English version by Skrivanek Sp. z o.o.
GUIDELINES FOR MANUSCRIPT SUBMISSION

Background

"Military Physician" has been published continuously since 1920, currently as a quarterly of the Military Institute of Medicine in Warsaw, Poland.

1. "Military Physician" publishes original (experimental and clinical) articles, reviews, reports on military issues, deontological papers, interesting case reports, articles on the history of medicine, descriptions of rationalization results, posthumous memoirs, letters to the editor, book reviews, article (reviews) summaries from international journals particularly on military health service, reports on meetings and scientific conferences, and announcements of events.

2. Before publication, each article is reviewed by 2 independent reviewers while maintaining anonymity.


4. With respect to the fact that unsolicited articles submitted to our Editorial Board are royalty-free, manuscript submission with a request for publishing will be understood as an implied consent of the Author(s) not to receive any royalty and to transfer copyright to the Military Institute of Medicine.

5. A clinical article for submission should be in accordance with the requirements of the Declaration of Helsinki. The chapter "Material and methods" should contain both the information on the approval of the Bioethical Committee and patients' informed consent to participate in a study. When using the results of studies conducted by other centers, such information should appear either in the text or in the acknowledgements.

6. Authors of clinical studies on medications (international name) and medical procedures should provide a description of research funding and the influence of the sponsor on the content of the publication.

7. The Author must provide the Editorial Board with the consent of the owner to use an image in an article.

8. Please submit your article to: Editorial Board of "Military Physician", 126 Szaşetrów St. 04-141 Warsaw 44 or by e-mail: lekarzwojakowy@wim.mil.pl

9. All Authors who wish to publish their papers in "Military Physician" are asked to carefully read and strictly follow the guidelines listed below. Failure to follow the requirements of the Editorial Board makes editing more difficult, increases costs and delays publication. Manuscripts not meeting the requirements will not be published, and those considered inadequately prepared will be returned to the authors for revision.

Manuscript

1. Manuscripts should be prepared using the MS Word text editor and sent by e-mail or by post on a 3.5" floppy disk or a CD.

2. The number of pages of the manuscript (including tables, figures and references) cannot exceed 30 pages for original articles, 30 for review articles, 20 for reports, 30 for articles on the history of medicine and 15 for rationalization articles. Reports on meetings and conferences should be concise (up to 5 pages) and discuss only significant issues.

3. An original publication may also take the form of a short temporary report.

4. Materials for printing

1) Text (with references, tables and figure captions) should be uploaded as a separate file. One page of the manuscript should contain 30 lines, about 60 characters each (must be about 1,800 characters). The text must be written in Times New Roman 12 point font and double spaced (this also applies to references, tables, captions etc.), with 2.5 cm left margin, and no right margin, i.e. with the 'flag'. Authors are asked not to format the titles, i.e., not to center or justify them, as well as not to use tabulator or automatic numbering (both within the text and references). A new paragraph should be started from the left margin without paragraph indentation. Please do not insert blank lines between paragraphs or enumerations. For typefaces, bold (semi-bold) and italics for foreign phrases may be used.

2) Please do not insert any graphics into the Word manuscript. Figures and tables should be referenced in the body of the text as follows: "in Figure 1" or "(Table 1)". The number of tables should be reduced to a minimum. Each table should be provided with captions in Polish and English in bold in the first row. Figures (including maps) and images should be sized in a separate file. Digital images should have a resolution of 300 dpi and be saved in TIFF format. Good quality traditional images should be delivered on photographic paper. The reverse side of each image delivered on paper should contain the Author's last name, the title of the contribution, a consecutive number and a marking indicating the top of the image.

5. Papers should be prepared carefully, in accordance with Polish spelling and with special attention to communicativeness and Polish medical nomenclature. Abstracts, keywords and figure captions translated into English should be identical with the Polish version and show an appropriate language level. Manuscripts that do not meet the criteria will be sent back to the Authors for revision.

6. Each article should include the following:

1) On the first page: main title in Polish and English, Author's or Authors’ (max. 10 people) first and last names, including academic degrees, full name of affiliated institute (institutes), head of the institute (academic degree, first and last name), below an abstract (up to 15 lines) with keywords in Polish and another abstract with keywords in English, corresponding Author, his/her postal address with postal code, telephone (fax) and e-mail address.

2) Main text

Original articles should be prepared according to the following structure: introduction, aim, material and methods, results, discussion, conclusions, references; case reports: introduction, case description, discussion, summary (conclusions), and references. Abbreviations and acronyms should be defined when first mentioned in the text and consequently used in the paper.

3) References should be presented according to the order they appear in the text. If the article has no more than four authors, all of them should be named, if there are more - a maximum of first three, followed by "et al.". References should be numbered using the keyboard, please do not use automatic numbering.

Examples of citations:

Journal articles:

Books:

Chapter of a book:

The list of references should include only those publications that were used by the Author and should be reduced to 20. All references should be cited in the text and the numbers of references should be put in square brackets. In order to avoid errors, titles should be copied from medical databases.

7. The paper should be accompanied by: a) Author's request to publish the paper with a declaration that the article has not been published before and not simultaneously submitted to any other journal b) approval of the head of the clinic, head of the department or head of the institute in which the research has been conducted, and in the case of a study carried out in several centers - the approval of all of them, c) Declaration of Conflict of Interest, and d) acknowledgements, if applicable.

8. The Editorial Board reserves the right to correct nomenclature and stylistic errors as well as to introduce abbreviations without consultation with the Author.

9. The Author receives 1 free copy of the issue in which his or her article has been published. For further copies, contact the Editor.

10. If the manuscript is not accepted for publication, the Editorial Board will return the submitted article to the Author.
<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors/Editors</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Introduction</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Air pollution and cardiovascular diseases – an underestimated problem</td>
<td>M. Wojdat, A. Stańczyk, G. Gielerak</td>
</tr>
<tr>
<td>17</td>
<td>Circulatory and respiratory effects of particulate air pollution</td>
<td>M. Krzyzanowski</td>
</tr>
<tr>
<td>23</td>
<td>The environmental domain related to the quality of life of the chronically ill</td>
<td>D. Kurpas</td>
</tr>
<tr>
<td>28</td>
<td>The awareness of the impact air pollution has on health in Poland</td>
<td>Ł. Adamkiewicz</td>
</tr>
<tr>
<td>32</td>
<td>Assessment of the burden of selected respiratory and cardiovascular diseases related to air pollution in eleven Polish agglomerations</td>
<td>A. Badyda, J. Grellier, P. Dąbrowiecki</td>
</tr>
<tr>
<td>39</td>
<td>Influence of organic dust on the respiratory system</td>
<td>T.M. Zielonka</td>
</tr>
<tr>
<td>46</td>
<td>Spirometry Days as an educative element on the causes, course and consequences of asthma and chronic obstructive pulmonary disease</td>
<td>P. Dąbrowiecki, D. Mucha, A. Gayer, A.J. Badyda</td>
</tr>
<tr>
<td>52</td>
<td>Methodology for assessing fate and oxidative stress effects of inhaled NPs on human volunteers. Two case studies</td>
<td>H. Graczyk, M. Riediker</td>
</tr>
</tbody>
</table>
CONTENTS

ORIGINAL ARTICLES

59 Knowledge levels concerning the radiological protection of patients and medical staff. An assessment of nursing department students of the Medical University of Warsaw
D. Olejniczak, J. Bastecka, U. Religioni, W. Boratyński, R. Słoniewski

64 Changes in the self-assessment of quality of life as a result of hematological disease
W. Skrzyński

CASE REPORTS

70 AD Hyper-IgE syndrome – cutaneous manifestations in the medical practice of allergologists, dermatologists and immunologists. A case report
G. Sławeta, E. Heropolitanska-Pliszka, B. Pietrucha, E. Bernatowska

How to subscribe to MP (Practical Medicine / Medycyna Praktyczna) publications

Methods of placing orders
- By telephone (Mon-Fri, 08:00-18:00):
  +48 800 888 000 (landline, toll-free hotline)
  12 293 40 80 (mobile and landline)
- At ksiegarnia.mp.pl
- By e-mail to zamowienia@mp.pl (please specify titles of the ordered items or their catalogue numbers, an address for correspondence, details for the invoice and the payment method of your choice)
- By completing a Direct Debit Form (direct debit), available at ksiegarnia.mp.pl

Payment methods
- Bank transfer/ postal transfer:
  Medycyna Praktyczna Spółka z ograniczoną odpowiedzialnością sp. k.,
  Rejtana St., 30-510 Kraków
  Account Number: 35 1600 1039 0002 0033 3552 6001
- Credit Card
- Cash on Delivery
- Direct Debit (Direct Debit Form available at ksiegarnia.mp.pl)

Shipping fees
- The shipping fee for ordered books and a one-time ordering fee for subscription is PLN 12. These prices are valid only in Poland.

Additional information
Subscribers to our journals are entitled to a discount on a single copy of each book and each special edition.
The address label includes information on:
- Delivery content
- Possible overpayment or underpayment in relation to the order
- Issue of each journal that has been recently paid or ordered

Contact
- By telephone (Mon-Fri, 08:00-18:00):
  +48 800 888 000 (landline, toll-free hotline)
  12 293 40 80 (mobile and landline)
- By e-mail (zamowienia@mp.pl)
## REVIEW ARTICLES

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>77</td>
<td>Familial hypocalciuric hypercalcemia in the differential diagnostics of hypercalcemia in adults</td>
<td>A. Kłosińska</td>
</tr>
<tr>
<td>83</td>
<td>Acts of suicide from the perspective of the Catholic faith</td>
<td>S. Pawłowski, W. Gruszczyński</td>
</tr>
</tbody>
</table>

## HISTORY OF MEDICINE AND MILITARY MEDICAL SERVICES

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>91</td>
<td>The problem of eye disease in the former Polish Army</td>
<td>K. Kopociński, Z. Kopociński, Cz. Jeśman</td>
</tr>
<tr>
<td>101</td>
<td>They were the authors of the “Lekarz Wojskowy” journal in the interwar period. University of Warsaw lecturers in the journal’s first decade. Part II</td>
<td>D. Augustynowicz, A. Karolak, H. Rudnicka, A. Kosater</td>
</tr>
</tbody>
</table>

## MISCELLANEA

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>111</td>
<td>The 90th birthday of Col. Sylwester Czaplicki, professor of medicine, chairman of the editorial board of Military Physician in the years 1970-1990</td>
<td>S. Ilnicki</td>
</tr>
<tr>
<td>116</td>
<td>In memory of Wojciech Silny, professor of medicine (1942-2015)</td>
<td></td>
</tr>
</tbody>
</table>

## REPORTS

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>118</td>
<td>Allergy, asthma, and rheumatic diseases - common problems for allergists, pediatricians, internists and rheumatologists. Report from the civil-military conference in Kielce, 24 October 2015</td>
<td>G. Sławeta</td>
</tr>
</tbody>
</table>
SPIS TREŚCI

V KONFERENCJA NAUKOWA IMIENIA GEN. BRYG. WOJCIECHA LUBIŃSKIEGO

9 Wstęp

10 Zanieczyszczenie powietrza a choroby układu sercowo-naczyniowego – niedoceniany problem
M. Wojdat, A. Stańczyk, G. Gielerak

17 Wpływ zanieczyszczenia powietrza pyłami na układ krążenia i oddychania
M. Krzyżanowski

23 Domena środowiskowa jakości życia osób przewlekłe chorych
D. Kurpas

28 Świadomość Polaków na temat wpływu zanieczyszczeń powietrza na zdrowie
Ł. Adamkiewicz

32 Ocena obciążenia wybranymi chorobami układu oddechowego i układu sercowo-naczyniowego z powodu zanieczyszczeń powietrza w 11 polskich aglomeracjach
A. Badyda, J. Grellier, P. Dąbrowiecki

39 Wpływ pyłów organicznych na układ oddechowy
T.M. Zielonka

46 Dni Spirometrii jako element edukacji w zakresie przyczyn, przebiegu oraz skutków astmy oskrzelowej i przewlekłej obturacyjnej choroby płuc
P. Dąbrowiecki, D. Mucha, A. Gayer, A.J. Badyda

52 Metodologia oceny badań stresu oksydacyjnego wdychanych nanocząsteczek u ochotników. Opis dwóch przypadków
H. Graczyk, M. Riediker

PRACE ORYGINALNE

59 Ocena poziomu wiedzy studentów kierunku Pielegniarstwo Warszawskiego Uniwersytetu Medycznego na temat ochrony radiologicznej pacjenta i personelu medycznego
D. Olejniczak, J. Bastecka, U. Religioni, W. Boratyński, R. Słoniewski

64 Zmiany w ocenie jakości własnego życia spowodowane chorobą hematologiczną
W. Skrzyński
PRACE KAZUISTYCZNE
70 Zespół hiper-IgE autosomalny dominujący – manifestacje skórne w praktyce lekarza alergologa, dermatologa i immunologa – opis przypadku
G. Sławeta, E. Heropolitanska-Pliszka, B. Pietrucha, E. Bernatowska

PRACE POGLĄDOWE
77 Rodzinna hiperkalcemia hipokalciuryczna w diagnoście różnicowej hiperkalcemii u dorosłych
A. Kłosińska

83 Zachowania samobójcze z perspektywy religii katolickiej
St. Pawłowski, W. Gruszczynski
### HISTORIA MEDYCyny I WOJSKOWEj SŁUŻY ZDROWIA

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>91</td>
<td>Problematyka chorób oczu w dawnym Wojsku Polskim</td>
<td>K. Kopociński, Z. Kopociński, Cz. Jeśman</td>
</tr>
</tbody>
</table>

### MISCELLANEA

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
</table>

### SPRAWOZDANIA

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>118</td>
<td>Alergia, astma, choroby reumatyczne – wspólne problemy alergologa, pediatry, internisty i reumatologa. Sprawozdanie z konferencji cywilno-wojskowej, Kielce 24.10.2015</td>
<td>G. Sławeta</td>
</tr>
</tbody>
</table>
“Memory is as important as the air we breathe.” This was the theme of the fifth scientific conference held at the Military Institute of Medicine in memory of Brig. Gen. Wojciech Łubiński MD, PhD, the deputy commandant of the Military Institute of Medicine and the personal physician to the president of the Republic of Poland, who died in the presidential plane crash near Smolensk. The subject of the conference was the impact of air pollution on health. This issue was the focus of Doctor Łubiński’s research conducted at the Military Institute of Medicine in collaboration with scientists from the Warsaw University of Technology. Recent years have revealed the significance of this problem; the evaluation of risk factors for premature death has shown that air pollution is one of the most harmful factors in the modern world, apart from inappropriate diet, high blood pressure, tobacco smoking, high body mass index, alcohol consumption, low physical activity, hypercholesterolaemia and hyperglycemia. That is why the World Health Organization urges that actions be taken to identify and prevent the health effects of air pollution. Therefore, it is no coincidence that this year’s conference was held under the auspices of the World Health Organization and attended by recognized experts from WHO. The significance of the event was further heightened by the honorary patronage of Tomasz Siemoniak, the Deputy Prime Minister of Poland and the Minister of National Defence, and Maciej H. Grabowski, the Minister of the Environment of Poland, who opened the conference, emphasizing the importance of this issue for the department of environmental protection. It was the first time that the conference has had an international character and been attended by lecturers from London, Bonn and Geneva.

Regrettably, the importance of air quality on the health is an issue not widely known in Poland, and it is underestimated not only by politicians, journalists and society, but also by physicians and scientists. It is paramount to expand the knowledge of the effects of nitrogen dioxide, carbon monoxide, ozone, sulfur dioxide, and, most of all, suspended particulate matter (i.e. PM$_{10}$ and PM$_{2.5}$), which cause serious health issues in Poland. In southern Poland, the recorded concentration of suspended particulate matter is the highest in Europe. Polish physicians and scientists have to raise awareness of the negative effects of particulate matter, which increases the prevalence and mortality rates of cancer, cardiovascular diseases and respiratory system diseases. It causes over 42,000 deaths annually and reduces life expectancy by 6-12 months. The significance of lifestyle modification for patients suffering from chronic diseases is a widely discussed issue. However, air pollution should always be taken into account as an important risk factor for death and for the development of these diseases. In the public debate on the reduction of carbon emissions, the health effects and the costs related to them are disregarded. The number of scientific studies on the effects of air pollution on the health in Poland is not sufficient. The Military Institute of Medicine strives to reduce this deficit by conducting research in collaboration with other scientific institutions and by promoting this issue not only during the annual General Wojciech Łubiński conferences.

The comparison of memory to air in the theme of the conference is intended to emphasize their comparable significance for society and to establish a link between a scientific subject and the idea that gave rise to this event. We tend to forget the consequences that air pollution has for our health. Similarly, we tend to forget people who have passed away. As time moves on, even tragedies as terrible as the presidential plane crash in which some of the most eminent figures in our country were lost tend to fade from our memory as they are overshadowed by other, more or less notable events. The organizers of the annual General Wojciech Łubiński conference – the Military Institute of Medicine, the Polish Respiratory Society and the Polish Federation of Asthma, Allergy and COPD Patients Organizations – seek to raise awareness of socially and medically significant problems. Remembering Wujec Łubiński is important because it makes us better, especially when we remember his endearing, warm, kind smile and the attitude he had towards his professional obligations, which he proudly considered his service.

Tadeusz M. Zielonka
Management Board of
the Polish Respiratory Society

Grzegorz Gielerak
Head of the Military Institute
of Medicine
Air pollution and cardiovascular diseases – an underestimated problem

Zanieczyszczenie powietrza a choroby układu sercowo-naczyniowego – niedoceniany problem

Małgorzata Wojdat, Adam Stańczyk, Grzegorz Gielerak
Department of Cardiology and Internal Diseases, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine, Warsaw, Poland; head: Prof. Andrzej Skrobowski MD, PhD

Abstract. Over the past few years, many studies have reported the negative impact of long term exposure to air pollution, not only on the pulmonary system but also on the cardiovascular system. Air pollution containing carbon, nitrogen or sulfur oxides, ozone, heavy metals and particulate matters of diameters between 2.5 μm (PM$_{2.5}$) and 10 μm (PM$_{10}$) are particularly significant. The aim of the study was to analyze comprehensively the potential mechanisms related to the adverse effects of air contamination on the cardiovascular system.

Key words: air pollution, cardiovascular system, fine particulate matter, risk factors

Introduction

Air contamination is frequently associated with the development of respiratory diseases; however, its adverse effects on the cardiovascular system have recently been emphasized. The negative impact of pollution on the circulatory system depends not only on the size of dust particles but also on their chemical composition, e.g. the presence of metals, organic compounds, endotoxins and other substances. Air contamination containing carbon oxides, nitrogen oxides, sulfur oxides, ozone, lead or suspended dust in the 2.5 to 10 μm diameter range is of particular importance. This contamination is associated with increased hospitalization and mortality rates due to cardiovascular diseases, especially in patients with concomitant cardiac failure [1], cardiac rhythm disorders [2], or both disorders simultaneously.

The risk of health deterioration is increased not only by long-term exposure at the place of residence, but also by short-term increases in air pollution at the workplace or while travelling as part of our daily activities. The ESCAPE (European Study of Cohorts for Air Pollution Effects) [3] results, published in January 2014, confirm without any doubt that prolonged exposure to dust particles suspended in the inhaled air increases the risk of coronary events by nearly 13%. Simultaneously, there is no lower safety level of exposure to air pollution, and a correlation has been observed with concentrations below the lower limits accepted in the European Union, which are much less restrictive than those recommended by the World Health Organization (WHO).
Smoking cigarettes, including passively, clearly increases the risk of adverse cardiovascular events due to air contamination. In current smokers the risk of arrhythmia, cardiac failure or sudden cardiac death is 14%, 31% and 57% higher, respectively, than in non-smokers [4].

The adverse effects of air pollution may affect patients already diagnosed with cardiovascular disease, as well as people with risk factors such as arterial hypertension, diabetes or lipid disorders. Therefore, actions reducing the impact of air contamination on the cardiovascular system should cover a wide segment of the population, and include both primary and secondary prophylaxis, conducted in patients diagnosed with circulatory disorders, whose percentage in the general population is increasing due to the ageing of society. It is significant that, according to a recent WHO report, out of seven million deaths in 2012, one in eight resulted from air contamination [5].

Epidemiology

In the past 15 years, an increasing number of studies have produced evidence linking air contamination with circulatory diseases. Generally, the studies can be divided into those evaluating the effects of short-term or chronic exposure to air pollution.

The limitations of the studies evaluating the effects of air contamination on the health of selected individuals result primarily from air pollution, as well as from simultaneous daily movements of the study subjects through numerous microenvironments. The connection between health effects and the presence of a given contaminant may even be impossible to prove, due to the complexity of the variables involved, variety of mixed contaminants, or the potential for the combined toxic effects of different components. Therefore, it is not surprising that exposure analysis is always burdened with measurement errors.

The first large, prospective cohort study conducted by Dockery et al. [6] demonstrated in a study conducted over a period of several years that there was an independent relation between chronic exposure to air contamination and mortality due to cardiovascular diseases, having considered the impact of sex, body weight, education, professional exposure, smoking tobacco and concomitant arterial hypertension, and diabetes. An increase in mean annual PM2.5 concentrations by 10 μg/m³ was associated with an increase in general mortality rates, mortality due to cardiovascular diseases and mortality due to pulmonary cancer by 4%, 6% and 8%, respectively [7]. The relation between adverse health effects was observed without any indication of a lower safety level, and it was most strongly correlated with PM2.5, sulfate molecules and SO2.

It is impossible to ignore the impact of urban geographic location, socioeconomic status or education on the increased risk of cardiovascular diseases. In a study by Hoek et al. [8], the observation of a group of 5,000 adults for eight years revealed that exposure to air pollution due to traffic was more closely correlated with mortality than general urban contamination level. Of the assessed parameters, the variable indicator of living close to a main transport artery most strongly correlated with cardio-pulmonary mortality. The results suggest that individual exposures to toxic air contaminants can vary not only between different cities, but also within a single agglomeration.

The Aphea-2 study [9] revealed a closer relation between changes in PM concentrations and mortality in those cities with higher NO2 concentration and warmer climates. Observed differences in population susceptibility, climate, time spent outdoors or on transport, as well as the general composition of pollution, were indicated in the description of regional variability in the estimated risk of death in both studies. Direct relations with ischemic heart disease, arrhythmia and cardiac failure were identified [10]. A statistically significant relation between PM2.5 and general mortality due to cardiovascular diseases was confirmed in the ACS study. If PM increased by 10 μg/m³ in long-term exposure, the risk of death was increased by 12% [4]. The total risk of arrhythmia, cardiac failure and cardiac arrest was also higher, without an increase in mortality ratio due to other causes. The outcomes demonstrate that air pollution contributes to the occurrence of both ischemic and non-ischemic cardiac incidents.

Pathophysiology

Observed differences in the results of epidemiological studies regarding the harmful effects of dust may be associated with differences between the populations analyzed [4, 10, 12]. PM essentially causes local inflammatory lesions in the respiratory tract and contributes to generalized oxidative stress. The cascade of reactions overlaps with rheological blood changes, which may result in thrombosis, disturbed cardiac rhythm and acute vascular events, both by atherosclerotic plaque instability and by long-term contribution to the development of atherosclerosis. Also important is disturbed balance in the autonomic system as a result of interactions between PM and neural reflex arcs.
Inflammation and oxidative stress

Exponents of the increased risk of cardiovascular events for which a direct correlation with exposure to PM was demonstrated primarily involved inflammation and endothelial damage parameters: C-reactive protein (CRP) [13-15], fibrinogen [16], interleukin 6 (IL-6) [17-21] and adhesion molecules: ICAM-1 (intracellular adhesion molecule-1) and VCAM-1 (vascular cell adhesion molecule-1), which are found both on the surface of cells and dissolved in blood serum. Increased IL-6 concentration is associated with an increased risk of cardiac incidents and death [19-21]. Concentrations of serum IL-6, IL-1 and granulocyte-macrophage colony-stimulating factors are elevated in healthy males following exposure to increased air contamination associated with forest fires, as well as in vitro after exposure of human macrophages to PM10 [22]. Short-term exposure to air pollution results in elevated platelet and PMN (polymorphonuclear leukocytes) count in the peripheral blood [23, 24]. Studies on animals demonstrated that exposure to diesel exhaust particulates (DEPS) stimulates the bone marrow to release these cells into the blood circulation system [25]. The Traffic-Related Air Pollution study conducted in Boston [26] demonstrated correlations between exposure to traffic-related pollution and increased concentrations of fibrinogen, leukocytes and blood platelets.

Another pathogenetic mechanism, related to the above, is generalized oxidative stress [27], resulting in oxidative modification of lipoproteins, nucleic acids and other systemic elements. This effect of PM is probably due to its composition, especially the presence of transition metals such as zinc, copper and iron [28]. Inhalation of air pollution containing the finest dust of coal, DEPS [29], PM2.5, O3 and cigarette smoke results in local inflammation and oxidative stress [30-37], while the presence of soluble transition metals in PM intensifies the generalized response [38]. In a study conducted in California, an inverse correlation was established between exposure to PM and the activity of homocysteine and superoxide dismutase containing copper and zinc [39]. Individual exposures to concentrated PM2.5 in the environment is also associated with an increased level of lipid and blood protein oxidation markers [40]. Oxidative modification of low density lipoprotein (LDL) results in its uncontrollable removal by the receptors on the surface of macrophages, which contributes to the development of early atherosclerotic lesions (foam cells).

Atherosclerosis and acute coronary incidents

Systemic inflammation contributes to the long-term development of atherosclerosis, as well as to sudden cardiovascular events in the short-term due to the acute instability of atherosclerotic plaque. Inflammation results in an impaired endothelial function in patients diagnosed with coronary disease [41], and directly contributes to the development of atherosclerosis de novo, such as through the proliferation of foam cells, expression of adhesion molecules, recruitment of monocytes to the arterial wall, stimulation of prothrombotic tissue factors and reduced activity of NO synthase [42].

Risk factors in atherosclerosis, myocardial infarction, stroke and thrombosis in people exposed to traffic-related pollution include mainly organic and inorganic coal particles [43, 44]. In a study by Pekanen et al. [45], a significant relation was found between the maximum depression of the ST segment during a submaximum exercise test and exposure to PM within a 2-day period before the test. Significant relations were also identified between symptom occurrence and acute (2 hours before the symptoms occurred) and subacute (average over several days) exposure to PM2.5 [1]. In patients with atherosclerosis, acute coronary syndrome can be caused by the reduced perfusion of the cardiac muscle due to a sudden arterial spasm, or destabilization of the atherosclerotic plaque with concomitant endothelial dysfunction.

Endothelial damage

Mechanisms promoting atherosclerosis are inevitably associated with endothelial damage. Possible acute systemic inflammations and oxidative stress are responsible for triggering endothelial dysfunction, leading to vascular stenosis [46]. Recent studies regarding the effects of PM revealed impaired endothelial function, assessed by ultrasound measurement of the ability of the brachial artery to increase the vascular lumen in response to congestion (flow mediated dilatation – FMD) [47], or albumin excretion in the urine (microalbuminuria) [48, 49].

Another marker indicating the endothelial function is the von Willebrand factor [50]. Its activity increased following an experimental two-hour exposure to ultrafine PM in patients with type II diabetes [51]. Brook et al. [52] demonstrated that inhalation of urban air pollution and ozone in high concentrations for 2 hours resulted in arterial spasm in healthy adults. Moreover, it has been shown that decreased endothelium-mediated arterial relaxation due to reduced production of NO and a
concomitant increase in endothelin production occurs in people exposed to DEPS [53].

**Procoagulatory effect**

It seems that solid microparticles of very small sizes (PM_{2.5} and smaller) and their soluble components (e.g. transition metals) directly affect the circulatory system after passing from the respiratory system [54]. It is also possible that chemically neutral microparticles affect the heart and vessels, demonstrating a procoagulatory effect [55] through activation of factor XII (contact factor, Hageman factor) [56] and increasing fibrinogen concentration. Coagulatory system disorders due to exposure to PM are associated with parameters such as prothrombin time [57], fibrinogen concentration [26], d-dimers [58] and plasminogen activator inhibitor-1 [59]. Increased fibrinogen concentration [24, 60] due to exposure to PM and SO_{2} [61] increases blood viscosity, which contributes to the initiation of a coronary incident [62]. Fibrinogen is also a well-established, significant and independent risk factor in myocardial infarction and cerebral stroke. Increased platelet aggregation may also be conducive to acute thrombosis observed after exposure to diesel exhaust fumes and UFPs (ultrafine particles) [54, 63].

**Proarrhythmic effect**

Triggering fatal tachyarrhythmias as a result of the reduced activity of the parasympathetic system may be an important aspect of the causal relation between air pollution and mortality due to cardiovascular diseases [64-67]. Changes in the autonomic system secondary to interaction with PM may also contribute to the instability of atherosclerotic plaque. The basic mechanisms responsible for dangerous tachyarrhythmias have not been explained, but they probably include activation of pulmonary neural reflex arcs, the direct effect of pollution on cardiac ion channels or the consequences of exacerbated systemic inflammation. These direct effects of air pollution reliably explain the occurrence of the fast (within a few hours) reactions of the circulatory system in the form of increased numbers of myocardial infarctions [1]. Reduction in heart rhythm variability is quick and inversely proportionate to the increase in PM concentration. In a study by Pope et al. [68], an increase in parasympathetic activation was observed in a group of patients with previously existing cardiac disease, which may demonstrate that in certain populations bradyarrhythmias constitute a risk factor for sudden cardiac death due to air pollution. The observed frequencies of cardiac rhythm disorders correlates with exposure to PM_{2.5}, particularly in high-risk individuals. Increased risk of death due to dangerous arrhythmias is positively correlated with mean 7-day PM_{10} concentrations [10]. In 100 patients with implantable cardioverter defibrillators (ICD), a 3-year observation study revealed that ICD discharges were most strongly correlated with NO_{2} and CO concentrations, whereas exposure to soot particles demonstrated a remote degree of correlation with such events [30].

**Effects of acute exposure**

Another important aspect of these studies is the demonstration of a correlation between increased cardiovascular risk and short-term exposure to PM. The largest studies assessing the effects of acute exposure include American NMMAPS (National Morbidity and Mortality Air Pollution Study) [69, 70] and European Aphea-2 (Air Pollution and Health and European Approach project) [9]. The studies present surprisingly similar results. In NMMAPS, 50 million people in 20 of the largest American cities were included in an observation study. The mean mortality rates were independently related to PM concentration on the day before death. Each increase in PM_{10} concentration by 10 µg/m³ was associated with an increase in cardio-pulmonary mortality and everyday incidents by 0.21% and 0.31%, respectively [70]. The Aphea-2 study demonstrated a stronger correlation between adverse health effects and air pollution [9]. For 43 million individuals in 29 European cities the estimated increase in daily mortality was 0.6%, for every increase in PM10 by 10 µg/m³ [71]. Additional analyses of Aphea-2 results regarding mortality in a 40-day period demonstrated that the risk of adverse health effects due to air pollution with the above increase in PM_{10} concentration by 10 µg/m³ was two times higher [71].

The collective analysis of the causes of hospital admissions demonstrated a significant increase in hospitalization ratio by 0.8% and 0.7% due to cardiac failure and ischemic heart disease for every increase in PM_{10} concentration by 10 µg/m³ [72]. More detailed studies revealed an increased risk of myocardial infarction [1], the necessity of ICD implantation [30] and myocardial ischemia during an exercise test [45]. Extreme increases in air pollution were also associated with elevated blood pressure during an episode of prolonged air stagnation [73]. Moreover, Asian studies demonstrated increased frequencies of ischemic strokes directly connected to changes in pollution concentrations [74, 75]. Summing up, the results indicate that short-term increases in air contamination may cause cardiac rhythm disorders, exacerbation of cardiac failure and acute cardiac ischemia of atherosclerotic origin, or cerebral stroke.
Clancy et al. [76] demonstrated a reduction in adverse health effects after deliberately decreasing air pollution concentrations. They compared data from a 72-month period regarding mortality before the use of coal for fires was prohibited in Dublin (Ireland) and after the introduction of the prohibition. The number of deaths due to reasons other than injuries decreased by 5.7%, and the number of deaths due to cardiovascular problems decreased by 10.3%. The authors estimated that as a result of the above prohibition, the number of deaths due to circulatory diseases was reduced by 243 cases annually.

Smoking tobacco and the effects of air pollution

Estimated causal relations between active or secondhand smoking (SHS) and cardiac diseases and cerebral strokes confirm the adverse effects of PM on the cardiovascular system. It is estimated that the risk of heart diseases in the non-smoking spouses of smokers increases by approx. 25%. However, a review of six studies analyzing the relationship between SHS at the workplace and cardiovascular diseases indicates that none of them individually reached statistical significance, although a positive correlation was found between a significant response to exposure depending on SHS intensity (measured in number of cigarettes smoked by co-workers) and the risk of coronary incidents [77]. A correlation was demonstrated between SHS and the subclinical forms of atherosclerosis such as significant intimal medial thickening of the carotid artery [78], reduced endothelium-mediated artery relaxation [34], and reduced coronary flow reserve.

High-risk populations

The above mechanisms of the adverse effects of PM on the cardiovascular system may affect a larger extent patients suffering from cardiac failure, arrhythmia, COPD, but also arterial hypertension, diabetes, dyslipidemia, including patients clinically silent. There is limited data indicating a synergism of PM effects in these high-risk groups [79, 80]; therefore, comprehensive studies on the effects of PM should be conducted in a broad clinical context. This applies also to pharmacological treatment, as certain medications reducing the intensity of risk factors may also reduce the adverse effects of PM [81].

Summary

Considering the above discussion, air pollution, including PM, significantly affects not only respiratory system, but also our cardiovascular system: both directly, due to the instability of atherosclerotic plaque or arrhythmias, and indirectly, by promoting the proatherogenic processes. Therefore, the development of studies focusing on the precise determination of pathomechanisms and the effects of pollution is of great importance, especially in the view of increasing industrialization and the decreasing ecological reserves of the environment.

Literature

Air pollution and cardiovascular diseases – an underestimated problem


75. Tsai SS, Goggin WB, Chiu HF, et al. Evidence for an association between air pollution and daily stroke admissions in Kaohsiung, Taiwan. Stroke, 2003; 34: 2612-2616
Circulatory and respiratory effects of particulate air pollution

Wpływ zanieczyszczenia powietrza pyłami na układ krążenia i oddychania

Michał Krzyżanowski
Visiting professor, Environmental Research Group, King’s College London; head: Prof. Frank Kelly

The article is based on a lecture presented on 24 April 2015 during the 5th Scientific Conference in honor of Brig. Gen. Assoc. Prof. Wojciech Lubiński MD, PhD: Health effects of air pollution at the Military Institute of Medicine in Warsaw.

Abstract. Intensive research conducted over the past 20-30 years has resulted in the recognition of the serious health effects of common air pollutants. There is especially extensive evidence relating to the effects on health of fine particulate matter, which increases morbidity and mortality rates due to cardiovascular and respiratory diseases. In Poland, over 42 thousand deaths annually and a reduction in life expectancy by 6-12 months can be attributed to fine particulate matter. Reducing the exposure of the population to air pollution is a necessary component of multisectorial activities aimed at the prevention of cardiovascular and respiratory diseases.

Key words: circulatory diseases, respiratory diseases, particulate matter, air pollution

Streszczenie. Intensywne badania naukowe prowadzone w ciągu ostatnich 20-30 lat doprowadziły do poznania poważnych skutków zdrowotnych powszechnie występujących zanieczyszczeń powietrza. Szczególnie dużo danych dotyczy wpływu na zdrowie drobnych pyłów zawieszonych. Prowadzą one do zwiększenia chorobowości i umieralności z powodu chorób układu krążenia oraz układu oddechowego. W Polsce drobnym pyłom zawieszonym w powietrzu można przypisać ponad 42 tysiące zgonów rocznie oraz skrócenie oczekiwanej długości życia o 6-12 miesięcy. Zmniejszenie narażenia populacji na zanieczyszczenia powietrza jest niezbędnym składnikiem wielosektorowych działań zapobiegających chorobom krążenia i płuc.

Słowa kluczowe: choroby krążeniowe, choroby układu oddechowego, pyły zawieszone, zanieczyszczenia powietrza

Introduction

Our knowledge regarding the health effects of air pollution has increased considerably in the past 20-30 years due to the intensive epidemiological, clinical and toxicological studies, conducted primarily in Western Europe, the United States and Canada. An important purpose behind these studies is to determine precisely the physical and chemical characteristics of pollution in terms of its consequences to health, as well as the organs and systems in the human body affected by contamination. A deeper understanding of these aspects and relationships enable better quantitative assessment of the effects of pollution on society’s health and the undertaking of more effective measures to prevent the diseases caused by pollution. The article presents the most important problems and illustrates them with examples from selected studies. Broader discussion of

the subject literature has occurred recently through the publications of the World Health Organization (WHO) [1, 2]. Since widespread exposure of the population to suspended particulate matter is the most serious health problem associated with air pollution in Poland, this article focuses on this matter.

Atmospheric air pollution and its consequences on health

Suspended particulate matter, next to nitrogen oxides and ozone, is the most common form of atmospheric air pollution affecting health in concentrations commonly occurring in the human environment [3]. A number of other air pollutants may have adverse effects on health and life, particularly in an industrial environment, or in rooms where harmful substances are present. A detailed
description of their health effects can be found in WHO materials, including guidelines for indoor air quality [4].

Important for the health is particulate matter (PM) of <10 μm of an aerodynamic diameter (PM10), which can pass the barrier of the upper respiratory tract and be inhaled into the lungs, and fine particulates/molecules of <2.5 μm in diameter (PM2.5) which can pass through the pulmonary alveoli into the blood flow, and can be transported with the blood to various parts of the human organism. The chemical composition of suspended particulate matter, which is a mixture of solid particles and liquids, changes over time and space. Sulfates, nitrates, ammonia, sodium ions, chlorine, potassium, calcium, magnesium, molecular carbon and its compounds, minerals, metals and polycyclic hydrocarbons are all often found in particulate matter. Suspended PM also contains biological material, such as allergens or microorganisms.

Particulate matter is released into the air as a result of combusting various substances (including coal, petroleum and wood), from internal combustion engines, and from different industrial processes. It is also produced due to road wear, brake wear and tire wear in traffic, as well as being carried away from the ground by the wind, especially in desert areas. Agriculture (breeding animals, soil fertilization) is the main source of ammonia in the atmosphere, while volcanic eruptions are significant sources of particulate matter in certain regions. The primary source of suspended particulate matter in Poland is non-industrial combustion processes (mainly in households - 50% PM10 and 50.8% PM2.5 in 2013). Combustion processes used in the production and energy transformation sectors release 9.7% and 10.3% of the total particulate matter, respectively, and combustion processes in industry account for 7.9% and 7.4% [5], with coal combustion being most responsible for this emission. Road transportation is the source of 8.7% of the total PM10 emissions and 12.9% of PM2.5 emissions in Poland.

The most considerable amount of particulate matter in the air is secondary PM, generated as a result of chemical reactions involving gas pollution in the atmosphere. Secondary particulates are created from nitrogen oxides (released by transport and industry) and sulfur dioxide, generated mainly during the combustion of sulfur-containing fuels, such as coal and petroleum. Most secondary particulates are fine particulates. Both secondary and primary PM2.5 can remain suspended in the atmosphere for several days or even weeks, carried by the wind for hundreds and thousands of kilometers. Therefore, is may pose a threat to health in places distant from the source of pollution. The part that individual pollution sources plays in population exposure may differ according to how much they form of the total emissions. For instance, road transport contributes more to the exposure of the urban population and people living close to roads with heavy traffic than its share in general emissions suggests. In rural areas the dominant source of exposure to suspended particulate matter is emissions from households where solid fuels are burnt (coal or wood).

Nitrogen dioxide (NO2) is a gas created through the oxidation of nitrogen oxide (NO) released in the process of combustion. It is found in high concentrations primarily in busy city centers and close to roads with heavy traffic. Carbon oxide (CO), a product of incomplete combustion, is also found near roads and streets where traffic is heavy.

Tropospheric ozone (O3) is a secondary pollutant, generated from NO2 in a photochemical reaction requiring solar radiation (UV). As ozone reacts easily with NO, ozone concentrations quickly decrease if NO levels are high, or solar radiation is reduced. As a result, exposure to ozone is increased in the middle of the day, in sunny weather and in those areas without heavy traffic.

In the urban environment with heavy traffic, exposure to suspended PMs often strongly correlates with exposure to other pollutants, such as NO2 and CO. Due to this correlation, it is quite challenging to determine the specific effect of each pollutant. The majority of the studies analyzing this problem indicate that the specific effects of fine particulates on the health are visible or even unchanged after considering the disruptive effect of other pollutants. However, the total effect of a mixture of air contaminants in the urban environment can be more pronounced than that based merely on PM10 or PM2.5 concentrations. Gaseous pollutants, especially NO2 and O3, have additional health effects [1].

Effects of suspended fine particulate matter on circulatory diseases

The first serious sign that air pollution affects the circulatory system was the finding of a relationship between the risk of death due to cardiovascular diseases and PM2.5 concentration at the place of residence in approximately 0.5 adult subjects observed for 16 years in a study by the American Cancer Society [6]. A similar relationship was found in this study for deaths due to lung neoplasms, but no correlation was found between mortality due to other causes and the level of pollution. Since circulatory diseases were the primary cause of death in the observed cohort (as in the entire American population), general mortality was also associated with the level of contamination with fine particulates at the place of residence. An almost linear relationship between risk and long-term mean PM2.5 concentration
was found in the entire range of exposure, from approx. 8 to 30 \( \mu g/m^3 \) PM\(_{2.5} \). An increase in pollution by 10 \( \mu g/m^3 \) was associated with approximately 6%, 9% and 14% higher mortality rates due to all causes of death, cardiovascular diseases and lung neoplasms, respectively.

By mid-2014, the results of 14 studies on the effect of long-term exposure to PM\(_{2.5} \) on mortality had been published. The studies used data from several years of observation of large cohorts (groups as many as 1.2 million in the study involving Rome citizens [7] and 2.1 million in the Canadian national-level cohort [8]). In 12 out of 14 studies the estimated relative risk (RR) was higher than 1.0 (i.e. the studies indicated a higher risk of death in individuals exposed to higher PM\(_{2.5} \) concentrations), although in some of the studies this finding was not statistically significant. Using appropriate statistical methods, an attempt was made during the analysis of the collected data to eliminate the effects of factors distorting the relationship between mortality and exposure to PM\(_{2.5} \), such as age, tobacco smoking, socioeconomic status, etc. The overall rate of the relative risk of death due to cardiovascular diseases in the summary analysis of all 14 studies was 1.10 (95% CI: 1.05-1.16) for 10 \( \mu g/m^3 \) PM\(_{2.5} \) [9]. In some of the studies, such as in the Canadian cohort [8], an increased risk of death associated with increased exposure was observed even with very low PM\(_{2.5} \) concentrations, which indicates that pollution has effects in concentrations below those recommended by the WHO Air Quality Guidelines from 2005 (10 \( \mu g/m^3 \) for mean annual PM\(_{2.5} \) concentration) [3].

In two recently published European studies, the risk of death due to cardiovascular diseases did not correlate with exposure to PM\(_{2.5} \) [10, 11]. However, in the same cohorts a relationship between the risk of circulatory disease and exposure was observed: in an English cohort the relationship concerned new cases of cardiac failure [12], and in the European ESCAPE study it concerned new cases of ischemic heart disease [13] and cerebral stroke [14]. The effect of medical care on reducing mortality in new cases of circulatory diseases associated with air pollution is under study.

In numerous studies conducted in the last decade the effects of daily changes in pollution level, with variations in different health indexes, were analyzed using time series methods or case cross-over. They demonstrated a relationship between increased risk of cardiovascular deaths or hospital admissions due to circulatory diseases and daily air pollution levels [2].

An example of a clinical study with controlled exposure level is the assessment of the effect of diluted diesel exhaust fumes inhaled by patients with coronary heart disease on the circulatory system [15]. When the air administered to patients contained exhaust fumes, the level of cardiac ischemia was increased, assessed on the basis of the ST segment of the electrocardiogram.

In 2009, the American Heart Association (AHA) conducted a systematic review of the literature regarding the effects of suspended particulate matter air pollution on the cardiovascular system [16]. The analysis covered the results of epidemiological, clinical and experimental studies on the effects of short-term and long-term exposure. The goal of the review was to formulate conclusions regarding the significance of the collected knowledge for cardiologists and other medical services treating and preventing circulatory diseases. Based on the analysis of the data collected, the authors of this large study stipulated that increased exposure to PM\(_{2.5} \) for a few hours to a few weeks can result in exacerbation of circulatory symptoms, cardiac failure and myocardial infarction, cerebral stroke or even death. An increased risk of the symptoms was observed in predisposed but not necessarily seriously ill individuals. Predisposed patients include elderly people and patients suffering from coronary disease or diabetes. Long-term exposure (of a few years) has a more pronounced effect on the incidence and mortality than short periods of increased PM\(_{2.5} \) concentrations; as a consequence, in populations under greater exposure the life expectancy is shorter by a few months or even years. The authors also demonstrated the biological mechanisms behind the observed health effects. There is strong scientific evidence that the symptoms are consequences of systemic inflammatory reactions triggered by the particulate matter which passes into the organism through the pulmonary alveoli. The evidence that particulate matter causes changes in the balance and function of the autonomic nervous system regulating cardiac activity is moderate. Very limited evidence supports the direct effect of particles and components of particulate matter which pass into the systemic circulation. The main conclusion derived from the analysis is expressed by the statement: “…Overall scientific evidence confirms causal relationships between exposure to PM\(_{2.5} \) and the prevalence and mortality due to circulatory diseases...”. They also indicated that mortality due to circulatory diseases decreased after a few years following the reduction in exposure to PM\(_{2.5} \). WHO experts reached similar conclusions having reviewed the most recent studies, available after publication of the AHA conclusions [1].

**Effects of suspended fine particulate matter on respiratory diseases**

The analysis of data from a long-term study by the American Cancer Society [6] indicated a clear correlation...
between mortality due to lung cancer and the level of exposure to suspended fine particulate matter. Further cohort studies confirmed this relationship, and numerous clinical and experimental studies determined the biological mechanisms behind the carcinogenic effects of air pollution, especially of suspended particulates. Based on the overall scientific evidence, the International Agency for Research on Cancer classified atmospheric air pollution, especially suspended particulates, as group I agents – carcinogenic to humans [17].

The relationship between mortality due to noncancerous respiratory diseases and long-term exposure to fine particulate matter is similar in strength to that observed for circulatory mortality (RR=1.10 for 10 μg/m³ PM<sub>2.5</sub>). However, there is considerable variability in the results of individual cohort studies published before 2014, and the risk ratio calculated in the summary analysis is not statistically significant (95% CI: 0.98-1.24) [9]. In the most recent study based on the analysis of mortality in the years 2004-2011, involving over 7 million adult Dutch people, a similar, but statistically significant relationship was found between the risk of death due to respiratory diseases and long-term exposure to suspended particulates (RR=1.13, 95% CI: 1.10-1.17) [18].

Long-term exposure to suspended particulate matter also increases the risk of the persistence of chronic respiratory symptoms in children. A summary analysis of cross-sectional studies conducted in 12 countries demonstrates that expectoration of sputum and morning cough are significantly related to PM<sub>10</sub> concentrations at the place of residence [19]. A risk of numerous other symptoms was also increased by exposure, but the relationship was not statistically significant. Prenatal exposure to PM<sub>2.5</sub> of babies born in Krakow resulted in the increased probability of recurring respiratory infections in the first 7 years of life [20]. However, no clear relationship was found between exposure to suspended particulate matter and COPD incidence in the cohort of over 8000 thousand subjects observed by general practitioners in England from 2002 to 2007 [21].

Studies on the effects of short-term changes in PM<sub>2.5</sub> or PM<sub>10</sub> concentrations in the air revealed that they cause a number of respiratory diseases and symptoms, often requiring hospital treatment [1, 2]. For instance, a panel study involving 94 COPD patients in London (median observation period: 518 days) demonstrated a relation between the risk of dyspnea and peak expiratory flow (PEF), and PM<sub>10</sub> on the preceding day [22]. A summary analysis of over 40 panel studies involving children with asthma demonstrated a significant increase in the frequency of asthma symptoms and cough, as well as PEF reduction on days when PM<sub>10</sub> concentrations were higher [23]. The daily number of visits by children aged 0-4 years old suffering from acute respiratory infections or pneumonia admitted to emergency departments in hospitals in Atlanta in the years 1993-2010 was associated with pollution level (including PM<sub>2.5</sub>) in the three days preceding the visit [24]. The relationship between incidence and exposure was more pronounced in children aged 1-4 years old than in infants.

An interesting example of research into the effects of short-term exposure of the respiratory system to traffic air pollution is a study conducted in a group of 60 adults with asthma in London [27]. Each study subject walked for two hours along Oxford Street during high bus and diesel traffic. On another day, each subject walked for two hours in Hyde Park. During the walks, the exposure of the subjects to a number of air pollutants was measured. Concentrations of PM<sub>2.5</sub>, PM<sub>10</sub> and NO<sub>2</sub> were much higher during the walk along the street than in the park. Before and during each walk, the patient's pulmonary ventilation efficiency was measured, and a detailed clinical test was performed in a nearby hospital both before, and after the walk. The analysis of results revealed reduced FEV<sub>1</sub> and FVC during the walks, and it was significantly higher during the walk along Oxford Street than in the park. The difference was more pronounced in individuals with greater asthma intensity, and it persisted for a few hours following the walk. Spirometric changes were associated also with disorders in the biochemical indicators of the immune system.

There is also data demonstrating improvements in the respiratory system following a reduction in the exposure to suspended particulates. A reduction in exposure to PM<sub>10</sub> in the years 1991-2002 was associated with a decreased risk of chronic symptoms, such as cough, expectoration, wheezing and dyspnea in a cohort of adult Swiss citizens [25]. In this study the observed reduction in exposure (by approx. 6 μg/m³ PM<sub>10</sub> on average) was estimated to prevent 3-10% of individual symptoms. Another example involved three consecutive cohorts of children aged 11 to 15 years old, conducted in the years 1994-1998, 1997-2001 and 2007-2011 in southern California [26]. In the study period, air pollution at the place of residence of the children continued to decrease (median PM<sub>10</sub> was reduced by 8.7 μg/m³, PM<sub>2.5</sub> by 12.6 μg/m³, NO<sub>2</sub> by 28.2 μg/m³, and ozone by 11 μg/m³). The analysis revealed an increased rate in the improvement in pulmonary ventilation efficiency (FEV<sub>1</sub> and FVC) with age, together with decreased exposure to fine particulates and nitrogen dioxide. This relationship was observed in healthy children, as well as in those suffering from asthma. In the 15 years of the studies, the frequency of reduced FEV<sub>1</sub> incidence (<80% of the expected value) was also reduced by half in 15-year-old children.
Health cost of air pollution in Poland

Although individual increases in the risk of death or occurrence of respiratory or circulatory symptoms due to air pollution is relatively limited, the common character of exposure and its effect on widespread diseases increase the number of cases explained by exposure. According to the estimates of the European Environment Agency, approximately 42 thousand deaths (within a margin of error of 28-55 thousand) annually in Poland can be attributed to exposure to fine particulate matter [28]. Fine particulates from sources associated with human activity (i.e. excluding particulate matter of natural origin) lead to a loss of 6 to over 12 months of life expectancy in Poland [29]. It is estimated that even if all the valid regulations and international agreements reducing the emission of atmospheric pollution were implemented, in 2025 the loss in life expectancy in Poland would exceed 6 months. In global comparative analyses of health risk factors, exposure to atmospheric air pollution has been classified as one of ten (out of 67) factors being the greatest significance for reducing lifespan, measured as DALY (disability adjusted life years) in Poland [30]. Exposure to indoor air pollution, resulting from use of coal and wood as fuel in households, is also among the top 10 risk factors. According to this analysis, of even greater significance for health in Poland than air pollution are factors associated with diet, high blood pressure, tobacco smoking, high body mass index, alcohol consumption, limited physical activity, high cholesterol concentration and high blood serum glucose concentration.

Summary

The obtained scientific evidence regarding the effects of air pollution on the health, as well as the health cost of pollution constitute a strong argument advocating a reduction in the population’s exposure to contamination, particularly of the exposure to suspended particulate matter. The experience of many developed countries shows that radical reductions of pollution is possible, both from a technical and economic point of view, and its positive health effects are measurable in the form of extended life expectancy and reduction in the frequency of diseases. The analysis of health effects resulting from the reduction of air pollution in the United States in the 1980s and 1990s serve as an example [31]. After taking into consideration the social and demographic conditions affecting health, as well as changes in the popularity of tobacco smoking, reduced exposure to fine particulate matter is believed to improve the life expectancy by about 0.61 years (±0.22 of a year) for every 10 µg/m³ of reduction in PM_{2.5} concentration. With a mean reduction in pollution in the USA by about 6.5 µg/m³ in the years 1980-2000, the gained life expectancy was 0.4 years, i.e. approximately 15% of the overall increase in life expectancy for USA citizens in that period.

The ageing of Polish society has resulted in an expected increase in the number of patients with circulatory and respiratory diseases, necessitating intensive prevention of those diseases. Limiting the emission of particulates and gases into the atmosphere is an essential element of the preventive measures. In the Polish context it means a radical reduction of coal and wood combustion in households, especially in cities. Also important is reducing the emission of traffic pollution by elimination of the most contaminating vehicles from cities, reduction of car traffic in city centers, and the promotion of clean public transport. These tasks are not the duties of health care; however, doctors and other employees of health care services should inform patients and society about the existing risk, and appeal for effective measures to reduce this risk. The last World Health Assembly showed the direction for such measures by adopting a resolution addressing the health effects of air pollution [32]. It calls upon all the WHO member states to intensify actions for the identification and prevention of the health impact of air pollution by the development of multisectoral cooperation in this field.

Literature

4. WHO guidelines for indoor air quality: selected pollutants. World Health Organization 2010
The environmental domain related to the quality of life of the chronically ill

Domena środowiskowa jakości życia osób przewlekle chorych

Donata Kurpas¹, ²
¹ Chair and Department of Family Medicine of the Medical University in Wrocław; head: Agnieszka Mastalerz-Migas MD, PhD
² State Medical School of Higher Vocational Education in Opole; head of school: Tomasz Halski PhD

This article is based on a lecture of the same title presented at the 5th Scientific Conference in honor of Brig. Gen. Assoc. Prof. Wojciech Lubiński MD, PhD "The impact of air pollution on health" on 24 April 2015 at the Military Institute of Medicine in Warsaw.

Abstract. Quality of life is a multidimensional structure that is assessed by taking into account the somatic, psychological, social and environmental aspects. In the modern health care model, the result of quality of life assessment is understood as an indicator of the effectiveness not only the medical but also the social and political support systems. This is a different process from assessing the effectiveness of the therapy only on the basis of the patients' somatic status in chronic care models. A high quality of life is a very important result of the health care systems, of its quality ratings and simultaneously a clinically relevant endpoint that reduces the severity of the symptoms, prevents relapses, lifts patients' satisfaction with the care and lowers medical costs. However, the analyses determining the importance of individual domains of quality of life are rare, especially the environmental domain. This paper presents the rationale for undertaking such targeted research as well as selected results from already completed projects. The article presents the results of studies to determine the significance of the environmental domains of quality of life in patients from rural areas, the elderly and those with chronic respiratory diseases. It was concluded that the QoL assessment result can be a sensitive indicator of the level of the unsatisfied needs of the chronically ill, and both the direct and indirect medical costs.

Key words: chronic diseases, environmental domain, medical costs, quality of life

Introduction

Chronic non-infectious diseases, being incurable, lead to irreversible pathological changes and, as a consequence, to the partial disability of a patient, inducing not only the need for long-term clinical observation and rehabilitation, but primarily the need for care within a biopsychosocial model [1, 2].

According to WHO data, 75% of the general population suffer from at least one chronic disease, while almost half of the patients with chronic diseases were diagnosed with at least two diseases that require regular contact with the health care system [3]. Chronic non-infectious diseases, spanning a wide range of diseases and conditions, are responsible for a significant burden on individuals and society, both in terms of medical costs and lost productivity. The global impact of chronic non-infectious diseases is immense, affecting the quality of life and the well-being of individuals, families, and societies worldwide.

Chronic non-infectious diseases encompass a diversity of conditions, including but not limited to diabetes, cardiovascular diseases, respiratory diseases, and neurological disorders. These conditions are characterized by long-term or chronic progression, often requiring ongoing management and treatment. The management of chronic non-infectious diseases involves a range of interventions, ranging from medical treatments and lifestyle modifications to psychological support and social services.

The impact of chronic non-infectious diseases on individuals and society is multifaceted. On an individual level, these conditions can significantly impair quality of life, leading to reduced physical and mental well-being, increased social isolation, and decreased capacity for work and daily activities. At a societal level, chronic non-infectious diseases impose substantial economic burdens through medical costs, lost productivity, and social support needs. The economic impact is not confined to healthcare expenditures but also extends to lost productivity, disability payments, and informal caregiving.

Moreover, chronic non-infectious diseases also contribute to social inequalities, as they disproportionately affect vulnerable populations, including older adults, lower-income communities, and minority groups. This exacerbates existing social disparities and highlights the need for equitable access to healthcare and support services.

The management of chronic non-infectious diseases requires a multidisciplinary approach, integrating medical, psychological, and social perspectives. Effective management strategies often involve self-management support, community health initiatives, and disease prevention programs. Addressing the social determinants of health is crucial, as these factors significantly influence the development and exacerbation of chronic non-infectious diseases.

In conclusion, chronic non-infectious diseases pose a significant challenge to individuals, healthcare systems, and society as a whole. Addressing these conditions requires a comprehensive approach, emphasizing prevention, effective management, and equitable access to care. Continued research and innovation are essential to improve outcomes and quality of life for those affected by these conditions.
diseases constitute 72% of all disorders diagnosed in a population of subjects above 30 years of age [4]. According to the data of the Central Statistical Office in Poland from 2009, chronic diseases and chronic conditions were diagnosed in 51% of the general population (46% in 2004), including 82% of patients above 50 years of age [5].

It is estimated that the population of patients suffering from chronic diseases will increase by 1% per year until 2030 [3, 4, 6]. In 2020, chronic diseases will be the cause of approximately 75% of all deaths worldwide and they will also become the main cause of disabilities, generating direct and, principally, indirect medical costs [7]. Even now chronic diseases constitute a significant economic and social burden for health care systems, society and, above all, for individual patients [3, 8].

The fact remains that chronic diseases, which are the main cause of death and disability, have been recently mentioned in global health care programs, and their undeniable economic burden has begun to be underlined. The prevention of chronic diseases could, within a ten-year period, prevent 36 million cases of premature death. However, this is potentially only possible by way of strengthening of the whole health care system [9].

The consequence of the introduction of medicine promoting the therapy of complications as a replacement for primary and secondary prevention are increasing the difficulties in assuring effective care for the increasing population of the chronically ill [4]. The problem of the coexistence of chronic diseases and insufficiently prepared health care systems is also being ever more emphasized [10]. In most cases, programs to improve the health services for the chronically ill involve the therapy of a single disorder, and it is rarely mentioned in studies that at least 50% of chronically ill patients are diagnosed with more than one illness [11]. This is even more important since the needs of patients with one chronic disease are different from those of patients with multiple diseases; further, the occurrence of one disease increases the risk of other diseases. It was demonstrated that in such cases there was an increased risk of a rapid deterioration in health condition or increasing disability, while the frequency of hospitalizations due to preventable impairments was considered a sensitive index of adequate care of such patients [12, 13]. The above-mentioned population of patients is becoming the target group of future health care systems, in which partnership leading to the observance of procedures for long-term therapy and periodic follow-up visits become increasingly important, as does cooperation aimed at health promotion and the prevention of the complications of chronic diseases, as well as focusing on caring for the social and mental spheres of patients, including local environmental threats [9].

The importance of quality of life assessment

Nowadays, there is a shift away from the assessment of functioning and effective therapy for chronically ill patients based solely on the indicators that describe the somatic state. Instead, elements are being used of a multidimensional structure known as QoL (quality of life). A QoL assessment in chronically ill patients analyses not only health-related factors, such as psychological, functional, and emotional well-being [14], but also non-medical elements, such as work, family life, social interaction, etc. [15]. The QoL analysis enables biopsychosocial assessment and facilitates effective diagnostic and therapeutic procedures, as well as procedures targeting social disorder prevention [3, 16]. The result of QoL is thus understood as an indicator of the effectiveness of not only medical, but also social and political support systems [17]. Lower QoL is observed among patients who use medical services more frequently [18]. The better the quality of their lives, the lower are the direct medical costs within the health care system. Special attention is drawn to a statistically significant relationship between the level of health care services and the emotional well-being of patients [19].

The purpose of chronically ill patient care is to improve the functioning of the patients and to reduce the cost of treatment by way of reducing the number of health care services [20]. According to the results of research studies conducted among chronically ill elderly patients, improvement in QoL may result in achieving both goals [18], especially if, following Faden, Leplege [21] and Frisch [20], who support the theory of “quality of life therapy”, we assume that the most important outcome of health care or the medical endpoint is preventing relapse or disease progression, lowering the severity of symptoms and increasing the patients’ satisfaction with the health care system, thus achieving a high level of quality of life.

The World Health Organization Quality of Life Questionnaire

The World Health Organization Quality of Life Questionnaire (WHOQoL) is one of the non-specific research tools used in projects which determine QoL in both healthy and ill people, both for cognitive and clinical purposes. The abbreviated version (WHOQoL-Bref) was constructed on the basis of WHOQoL-100 by WHO Group for the Research on Quality of Life [22]. High sensitivity was observed regarding QoL level connected
with health, especially in chronically ill patients, regardless of the type of impairment and cultural region of the patient [23]. The scale was also validated in the Polish population [24], with an internal consistency of the Polish version of WHOQoL-Bref (α-Cronbacha) of 0.90 [23].

The WHOQoL-Bref allows determination of the quality of life profile within the scope of four domains. The physical domain includes everyday activities, drugs and treatment dependency, level of energy, fatigue, pain and discomfort. It also determines relaxation, sleep and ability to work. The psychological domain evaluates the area of physical appearance, negative and positive feelings, self-esteem, spirituality, personal faith, thinking, learning, memory and concentration. The social relations domain concerns personal relationships, social support and sexual activity. The environmental domain, in turn, includes financial resources, freedom, physical and mental safety, the assessment of health care including its quality and accessibility, and defines the home environment of a patient, possibilities of acquiring new information and skills, analyses the possibilities and participation in recreation and leisure, the physical environment of a patient (air pollution, noise, traffic, climate) and transport. The questionnaire also includes two questions that are analyzed separately. The first question concerns the individual general perception of the quality of a patient's life and the second concerns the perception of the patient's health [22].

However, projects assessing QoL and determining the importance of individual domains of quality of life are rare – especially the environmental domain. Below we present selected results of already completed studies carried out among chronically ill patients staying under the care of primary care physicians, with the use of the WHOQoL-Bref questionnaire, describing the role of the QoL environmental domain.

The importance of the environmental domain of quality of life

Patients from rural vs. urban areas

In studies comparing variables defining the QoL of patients of primary health care centers living in rural areas (n=1239) and in urban areas (n=1886), a higher QoL was confirmed in the environmental domain among rural patients (13.6 vs. 13.4, p=0.015) with OR (odds ratio) rural areas vs. urban areas: 1.341 (95% CI: 1.067–1.687). A low level of QoL in the environmental domain was observed statistically significantly more often among women living in urban areas, patients living in rural areas with low body weight, and patients living in urban areas with high body weight and high BMI. A statistically significant positive correlation was found between the environmental domain of QoL and the psychological domain, and an increase in health-related behaviors. A high level of general QoL remained statistically significantly correlated with a low level of medical services, regardless of the place of living [25].

Elderly patients

In studies conducted in 2010-2012 in the provinces of Dolnośląskie, Opolskie, Śląskie, Zachodniopomorskie, Wielkopolskie, Łódzkie, and Podlaskie, involving chronically ill elderly patients (n=1974), (71.60 years ± 7.98) from 131 primary health care centers, the average QoL in the environmental domain was established at 13.24 ± 2.21. Low values of the general QoL were observed in patients with higher numbers of chronic diseases and medical services during the last 3 years. Low QoL in the environmental domain was confirmed in the oldest group of patients, in patients with high BMI, unmarried, low educated, with a higher number of chronic diseases, with a higher number of home visits, with more advice taken via telephone, a higher number of visits of a district nurse during the last 12 months, and a higher number of hospitalizations during the last 3 years. In elderly patients, the previous observations [25] were confirmed that defined positive correlations between the environmental domain of QoL and the psychological domain, an increase in health-related behaviors, as well as a negative correlation between the general QoL and the level of medical services [18].

Patients with chronic respiratory diseases

Among patients with chronic respiratory diseases (n=594, age: 59.8 years ± 14.9) from 136 primary health care centers, the average QoL in the environmental domain was 13.4 ± 2.3 (alongside the social relations domain it was the highest value among the components of the general QoL) [26]. The study was conducted in 2012-2013 in the Dolnośląskie, Opolskie and Zachodniopomorskie provinces. Low QoL values in the environmental domain were observed especially in elderly patients, men, married, low educated, living in rural areas, with higher BMI, with a higher number of chronic diseases, a higher number of hospitalizations, a higher number of visits to a primary health physician, home visits, with more advice taken via telephone, with a higher number of visits of a district nurse, and with a higher index of services (the same as the number of services provided during visiting a primary care physician). A correlation was confirmed between the values of the environmental, psychological and physical domains. The study also showed negative correlations between the general QoL
and the number of medical services for patients with chronic respiratory diseases [26].

In an observation targeted at the assessment of the level of unmet needs (not only health-related), conducted in 2013-2014, involving patients with chronic respiratory diseases (n=214, age: median 65 years, min–max. 18–90 years) from 130 primary health centers in the Dolnośląskie, Opolskie, Zachodniopomorskie and Podlaskie provinces: the median of the QoL environmental domain value was estimated at 13.5 (min-max. 8.5–19.5). Alongside the social relations domain it was the highest value among the components of the general QoL. More importantly, high values of QoL in the environmental domain increased by a factor of 410 the chances for a high Camberwell index, which is equivalent to a high level of satisfied needs of patients (a factor of 94 at high values in the psychological domain, 53 in the social relations domain, and 33 in the physical domain). The study confirmed statistically significant correlations between QoL and the level of satisfied needs (the higher QoL value, the lower the level of satisfied needs) [27].

**Conclusion**

The European Health Report 2012 [28] underlines the significance of the well-being of the population, expressed by the quality of life, which is an integral part of a new European strategy Health 2020, adopted by 53 member states in September 2012. In the report it was stressed that well-being and health are of a multidimensional and interactive nature, and have one common crucial factor, which is the functioning of the health care system [28]. It is worth noting that visits of patients with chronic diseases may reach as much as 80% of all interventions within primary health care. In this group of patients, 15% are diagnosed with at least three chronic diseases, while 30% of hospitalizations are a consequence of the clinical exacerbation of chronically ill patients [29]. The result of the QoL assessment can be a sensitive indicator of the level of the unmet needs of chronically ill patients, and of direct and indirect medical costs. Considering the components of QoL, they are worth being analyzed in relation not only to the current clinical state of a chronically ill patient (somatically or mentally), but also with the widely understood component of life and work environment. It is possibly the QoL environmental domain assessment that bears the greatest significance in defining the efficiency of the health care system [27].

**Literature**

6. World Health Organization: Chronic diseases. Available at: http://www.who.int/topics/test/chronic_diseases/
Access: 15/01/2013
7. Wu SY, Green A. Projection of chronic illness prevalence and cost inflation. RAND Health, Santa Monica, CA, 2000
13. Wright N, Smeeth L, Heath I. Moving beyond single and dual diagnosis in general practice: many patients have multiple morbidities, and their needs have to be addressed. Br Med J, 2003; 326: 512-514
The awareness of the impact air pollution has on health in Poland

Świadomość Polaków na temat wpływu zanieczyszczeń powietrza na zdrowie

Łukasz Adamkiewicz
Health & Environment Alliance (HEAL) in Warsaw

The article is based on a lecture presented on 24 April 2015 during the 5th Scientific Conference in honor of Brig. Gen. Assoc. Prof. Wojciech Lubinski MD, PhD: Health effects of air pollution at the Military Institute of Medicine in Warsaw.

Abstract. The impact air pollution has on health is an issue that increasingly appears in the press. Studies related to this topic have been underway for at least three decades; however, their results do not directly translate into an adequate level of awareness in society. This article determines the current state of consciousness of Polish people on the impact of air pollution on health, and how this can be improved. According to surveys, Polish people consider health care as a problem that needs to be solved as soon as possible, whereas the quality of the environment appears low in this ranking. This paper draws attention to the crucial role of issuing legal regulations in favor of improving air quality in educating society about the negative impact of atmospheric pollution. Equally important is the role of the medical environment in improving public awareness of the health consequences of environmental pollution.

Key words: air pollution, eco-health awareness of Polish people, pro-environmental regulations, social campaigns

Introduction

Atmospheric air pollution adversely affects health, a fact that has been confirmed by numerous scientific studies [1-3]. A key study in this field was that conducted by Dockery et al. [1] in 1993, revealing the impact of air pollution on mortality rates in the USA. The analysis was based on a time series, in which survival was analyzed in groups of over 1000 people in each city, over a period of 16 years. The results clearly demonstrate a correlation between particulate matter concentration in the air and the number of premature deaths. The 1990s and the early 21st century witnessed a considerable increase in the number of studies and publications on the effects of atmospheric pollution on health, in terms of cardiology, pulmonology, allergology and oncology [4-7]. With time, review articles and metaanalyses were drawn up [8-12], where the World Health Organization report from 2013 [12] is of particular importance as it answers a number of questions about the impact of individual atmospheric pollutions on selected health effects. Very interesting is the statement that no concentration of suspended particulate matter of 2.5 µm in diameter or smaller is safe for the health, which has been confirmed in numerous research studies [8, 10-12]. The adverse effects of air pollution on human health have been proven...
without doubt; however, facts do not always find reflection in society's understanding of a given problem.

The aim of this article is to determine the level of awareness in Poland of the health effects of air pollution, and to define actions which may increase their awareness.

The awareness that the impact air pollution has on health in Poland

A society's understanding of the impact of air on health is usually studied using questionnaires. Direct conversation is more time-consuming, but it provides more interesting and comprehensive results. However, it is limited by the difficulties in the statistical analysis of its outcomes. The National Fund for Environmental Protection and Water Management every year conducts a survey to evaluate the awareness of ecological behavior among Polish citizens [13]. When asked about the most serious problems in Poland, they prioritize health care. Studies in consecutive years demonstrate a deterioration of health care as perceived by Polish citizens. In a ranking of 15 responses, environmental protection was placed in 13th position. Despite the impact of the environment on the quality of public health, it is clear that in Poland the awareness of the health consequences of poor air quality is insufficient. According to the survey respondents, the greatest problem involves waste, then air quality, followed by water pollution.

Frequently the substances in the air are too small to be visible to the unaided eye. For high concentrations and the presence of smog, air pollution is visible, but society sometimes remains unaware of its impact on health. Air pollution primarily affects the organism after a long period (usually many years), so its effects on health are not clearly perceivable except by those patients suffering from chronic diseases, such as asthma, COPD or atherosclerosis. In these patients, high concentrations of atmospheric pollution result in an immediate reaction from the organism [14-16].

In the past two years, during seminars and conferences on the effects of environmental pollution on health, the author discussed this issue with people living in different cities. The awareness and attitudes in this regard were varied, but certain common elements could be observed. The majority of respondents were aware of the adverse effects of air pollution on health, but their understanding of the problem was limited. Most people associated air pollution with the potential occurrence of coughs or reduced pulmonary efficiency. The majority of people were not aware of the close relationship between the concentration of air pollution and asthma, COPD, ischemic heart disease or pulmonary neoplasms.

Simultaneously, the source of knowledge is important for the local community. Research studies undertaken in Poland are as convincing as the World Health Organization reports.

In Poland, people's awareness of the effects of air pollution on health occurring at the place of residence is an important factor. Air quality is worst in the cities of southern Poland, situated in valleys and basins. People living of Zakopane, Krakow and Katowice are constantly struggling with high concentrations of suspended particulates in the air; therefore their awareness is considerably higher than that of people from the Pomeranian region. The high awareness of the impact of air pollution on health presented by people living in the southern regions of Poland results in Smog Alerts, which bring people together in an effort to improve the quality of the air in their surroundings. The most active organizations, united as Polish Smog Alert, operate in the Krakow, Podhale and Lower Silesian regions. All these groups operate according to a similar scheme, the first stage of which consists in inviting experts (usually from the medical milieu) to help in the preparation of educational materials, lectures, opinions etc. The next step is publicizing the problem of air pollution in regional media, which results in the increased interest of local authorities in the problem. The third stage involves proposals and detailed legal changes at a local government level in order to improve the situation.

Laws facilitating the improvement of air quality

The current awareness and understanding of the issue is inadequate to introduce change, and the legal tools available in Poland are not sufficient to solve the problem of air quality. Acceptable standards for air pollution in Poland are defined in the Regulation of the Ministry of the Environment of 18 September 2012 on the levels of certain substances in the air [17]. For PM$_{2.5}$ and PM$_{10}$ particulates, the Polish standards are only half as restrictive as the recommendations of the World Health Organization from 2005 [18]. However, in Poland in 2013, in 36 out of 46 spheres (78%) the acceptable norms of PM$_{10}$ concentration were exceeded, both according to the Polish and European provisions [19]. Air pollution in 2013 was not exceptional, and every year in Poland the standards for air pollution are exceeded. According to the latest Air Quality report of the European Environment Agency from 2014, Poland ranks first in PM$_{2.5}$ concentration, and second in PM$_{10}$ concentration [20]. As social awareness of the impact of air pollution on health in Poland is insufficient, this does not help to improve the situation.
The acceptable emission levels for industry and the energy sector are legally regulated [21]. In transport they apply only to new vehicles, while other vehicles need to comply with the emission standards according to the parameters applicable at the time the vehicles were produced [22]. This means that regulations in the transport sector which could reduce the emission of air pollution are limited, whereas the urban and domestic sector, which generates the most particulate matter pollution, is not legally regulated, except in the case of the waste incineration ban [23].

The legal solutions applied in many other European countries could be successfully introduced in Poland. In the power industry, the regulations regarding the installation of renewable domestic energy sources, known as prosumer sources, including photovoltaic cells on roofs, will enable the load on the grid to be reduced in summer, and hence decrease the emission of pollutants. Indirectly, due to the reduction in air pollution, local awareness of the impact of air pollution on health will increase. Also, we need to gradually depart from a coal-based energy system.

The emission of pollutants generated by transport can be reduced by the introduction of low-emission zones. Such arrangements have been successfully introduced in many European cities, such as London, Berlin and Stockholm. Vehicles that do not comply with the emission standards established by local authorities cannot enter certain zones in the city at certain hours. Solutions like this reduce traffic congestion, and fees from the system are usually used directly to develop public transport. However, these measures are not sufficient to improve air quality in all areas of Poland.

In the southern cities air pollution is generated mostly by boilers and furnaces used to heat housing. There are a number of legal solutions to enable the reduction of emission of pollutants from the urban and domestic sector. Similarly to the low-emission zones for vehicles, local governments could determine the type of fuel acceptable for urban and domestic use (e.g. coal with a sulfur content below 1%). The parameters for boilers for domestic use should also be defined, as due to the absence of such regulations on a national level, all kinds of solid fuels are acceptable, including ‘coal muds' with more than a 50% ash content. Domestic boilers that release less pollution are available on the market, and can also use less fuel, which translates into lower costs.

Legal changes to improve air quality result in a considerable increase in social awareness of the impact of air pollution on health. In 2013, the Małopolskie Voivodeship council passed a ban on coal use for individual heating systems in Krakow. Before introducing the ban, a large educational campaign was organized, infographics were developed and presented on social networks, billboards, and handed out in the streets, while marches were organized in support of clean air, as well as seminars with recognized Polish and foreign scientists. However, none of these efforts met with as much interest from the media and citizens as the council’s regulation [24].

Air pollution affects health and generates measurable costs; however, until the costs are monetarized, e.g. in the act prohibiting the use of coal, the awareness of the impact of air pollution on health will remain limited.

Summary

Educating citizens is important; however, it has to include all social groups, especially the decision makers. Increasing social awareness through educational actions has its limitations, so education should not be the only means of raising social awareness. The participation of doctors as experts in the decision-making process supporting the social groups striving for improvement of air quality considerably contributes to increasing social awareness on the impact of air pollution on health. Attention paid by the media to the problem of air quality is relatively limited, as people take a serious interest in a given problem only when it affects them directly. A permanent modification in the behavior of people is achieved by legal changes.

Literature

The awareness of the impact air pollution has on health in Poland

results from 11 European cohorts within the ESCAPE Project. Environ. Health Perspect, 2014; 122: 919-925


17. Rozporządzenie Ministra Środowiska z dnia 24 sierpnia 2012 r. w sprawie poziomów niektórych substancji w powietrzu. [Regulation of the Ministry of the Environment of 24 August 2012 on the levels of certain substances in the air]


20. Rozporządzenie Ministra Środowiska z dnia 4 listopada 2014 r. w sprawie standardów emisyjnych dla niektórych rodzajów instalacji, źródeł spalania paliw oraz urządzeń spalania lub współspalania odpadów [Regulation of the Ministry of the Environment of 04 November 2014 on emission standards for certain types of installations, fuel incineration sources and waste incineration or co-incineration devices]

Assessment of the burden of selected respiratory and cardiovascular diseases related to air pollution in eleven Polish agglomerations

Ocena obciążenia wybranymi chorobami układu oddechowego i układu sercowo-naczyniowego z powodu zanieczyszczeń powietrza w 11 polskich aglomeracjach

Abstract. The European Environment Agency indicates that due to ambient PM$_{2.5}$ air pollution more than 42,000 people a year die prematurely in Poland. This is one of the highest rates in the European Union in terms of national population. This paper attempts to assess the risk of premature death from selected diseases, attributable to PM$_{2.5}$, in 11 Polish urban agglomerations, with a total of over 6.5 million inhabitants. The analyses demonstrate that an average of 6,044 deaths from cardiovascular and pulmonary diseases (including 3,057 cases of ischemic heart disease), and 1,104 cases of lung cancer can be attributed to fine particles. This situation requires urgent systemic changes aimed at the radical improvement of air quality in Poland.

Key words: air pollution, fine particulate matter (PM$_{2.5}$), pulmonary disorders, cardiovascular diseases, ischemic heart disease, lung cancer, premature mortality

Streszczenie. Europejska Agencja Środowiska wskazuje, że w Polsce z powodu zanieczyszczenia powietrza atmosferycznego pyłem PM$_{2.5}$ umierają przedwcześnie ponad 42 tys. osób rocznie. Jest to jedna z największych w Unii Europejskiej śmiertelności z tego powodu w odniesieniu do populacji kraju. W pracy podjęto próbę oszacowania ryzyka przedwczesnych zgonów z powodu wybranych chorób, przypisywanych zanieczyszczeniu powietrza pyłem PM$_{2.5}$, w 11 aglomeracjach miejskich Polski, zamieszkiwanych łącznie przez ponad 6,5 mln osób. Przeprowadzone analizy wskazują, iż zanieczyszczeniu powietrza pyłem PM$_{2.5}$ można przypisać średnio 6044 przypadki zgonów z powodu chorób układu krążenia lub oddychania (w tym 3057 przypadków choroby niedokrwiennej serca), a także 1104 przypadki nowotworu płuc. Wymaga to szybkiego podjęcia zmian systemowych zmierzających do radikalnej poprawy jakości powietrza w Polsce.

Słowa kluczowe: zanieczyszczenie powietrza, pył bardzo drobny (PM$_{2.5}$), choroby układu oddechowego, choroby sercowo-naczyniowe, choroba niedokrwiennej serca, nowotwór płuc, przedwczesna umieralność

Corresponding author
Eng Artur Badyda PhD
Warsaw University of Technology, Faculty of Environmental Engineering
20 Nowowiejska St., 00-653 Warsaw
e-mail: artur.badyda@is.pw.edu.pl

Delivered: 30/09/2015
No conflicts of interest were declared.
Copyright by Military Institute of Medicine
Introduction
In Europe, as much as 75% of the population live in cities [1], while in Poland the percentage is lower at slightly above 60% [1]. According to European Environment Agency (EEA) estimates, exposure of the urban population in Europe to air pollution with PM$_{10}$ (fine particles with a mean aerodynamic diameter <10 µm [2]) and PM$_{2.5}$ (very fine particulate matter with a diameter <2.5 µm [2]) at levels exceeding permissible concentrations covers 20-33% of the population. However, if we consider the much lower lever of air pollution recommended by the World Health Organization, the percentage of people in Europe living in urban areas exposed to increased dust concentrations is 85-96%.

Exposure to high concentrations of air pollution is related to a broad spectrum of acute and chronic diseases, especially with regard to respiratory and cardiovascular systems [3, 4]. According to the WHO estimates, pollution with dust causes about 8% of deaths due to lung cancer in the world, 5% due to cardiovascular system diseases and 3% due to respiratory tract infection [5]. The problem of exposure to PM$_{2.5}$ concerns most countries, but it is of special importance to countries of average income, like Poland [5]. WHO also indicates that in 2008, in cities all over the world, there were about 1.3 million premature deaths caused by atmospheric air pollution [6]. Data from 2012 which also covers rural populations show that atmospheric air pollution may be related to 3.7 million premature deaths [7]. According to the current EEA report [8], in the European Union alone the annual number of premature deaths caused solely by exposure to PM$_{2.5}$ exceeds 400,000, whereas in Poland it is almost 45,000 (which is one of the highest rates in terms of national population).

The scale of the problem is also indicated in scientific material on the increased number of lung neoplasms caused by exposure to air pollution. The material formed a basis for a decision of the International Agency for Research on Cancer (AIRC), which classified external air pollution (and pollution with dust separately) among substances that are carcinogenic for humans (group 1) [9].

The aim of the paper was to initially assess the burden of mortality caused by cardiopulmonary diseases in general, ischemic heart disease and lung cancer due to exposure to increased PM$_{2.5}$ concentrations in the atmospheric air of eleven Polish agglomerations

Material and methods
The paper used data of the State Environmental Monitoring System (via the Chief Inspectorate of Environmental Protection) on PM$_{10}$ and PM$_{2.5}$ levels in eleven Polish urban agglomerations (i.e. having a population of 250,000 or more) in the 2006-2011 period. The study also used data concerning mortality caused by lung cancer, ischemic heart disease, cardiopulmonary diseases in general and deaths by all causes except for external ones, covering the same period of time. The information was obtained from the databases of the Central Statistical Office of Poland (Local Databank) and reports of the Department of Epidemiology at the Oncology Centre.

The assessment of air quality in particular agglomerations, and at the same time the assessment of population exposure to PM$_{2.5}$, was based on hourly mean dust concentration rates, which were aggregated to annual means. Since some of the monitoring stations did not measure PM$_{2.5}$ concentration in all the analyzed years, it was assessed on the basis of the PM$_{10}$ concentration. The factors converting PM$_{10}$ to PM$_{2.5}$ were defined on the basis of parallel measurements of both fractions from the same station (if available) or measurements from different stations in the same city. It was assumed that the factors were specific for a given city. Depending on the agglomeration, they were within a range 0.61-0.84.

In the case of mortality data, aggregated annual data covering deaths from the above-mentioned causes were used. The information about the total number of deaths unrelated to external causes and deaths due to cardiopulmonary diseases was obtained directly from the database of the Local Databank for particular urban agglomerations. Due to the lack of specific data on deaths caused by ischemic heart disease for these urban agglomerations, mortality was estimated on the basis of data for the provinces in which the particular cities were located, assuming the same proportion of deaths due to ischemic heart disease in the province and agglomeration as in the case of the total number of deaths due cardiovascular diseases. Data on mortality due to lung diseases were taken from the Oncology Centre reports.

To calculate burden of diseases causing deaths related to atmospheric air pollution with PM$_{2.5}$ (relative risk of mortality related to exposure to PM$_{2.5}$), exposure-response functions were used, which were defined in a report on the European prospects of the environmental burden of diseases [10]. Relative risk factors standardized for unit exposure to PM$_{2.5}$ were taken from study results published by Pope et al. [11] in the case of lung cancer and cardiopulmonary diseases, and Krewski et al. [12] in the case of ischemic heart disease and total mortality with the exception of external causes.
Results

Annual mean PM$_{2.5}$ air concentration in all the analyzed years and agglomerations were within the range 14.3 µg/m$^3$ to 52.5 µg/m$^3$ (Fig. 1), with the lowest values in the cities of northern Poland (Białystok, Gdańsk, and Szczecin), and the highest values in the agglomerations located in the south of the country (Kraków and Katowice). In the analyzed period, the annual mean PM$_{10}$ and PM$_{2.5}$ concentrations exceeded the permissible national and European limits in 7 and 8 respectively out of 11 urban agglomerations. In 2011, in 5 of the analyzed cities PM$_{2.5}$ and PM$_{10}$ levels were higher than in 2006.

In particular years in the analyzed agglomerations, a similar distribution of relative risk of mortality due to disease related to exposure to PM$_{2.5}$ was observed. Mean values of the relative risk of mortality due to particular diseases for 2006-2011 are presented in the table.

Relative risk of mortality due to the analyzed diseases that may be associated to PM$_{2.5}$ is directly proportional to the conditions of this fraction in the atmospheric air of a given agglomeration, and similarly has the lowest values for the cities in the north of Poland and the highest values for the cities located in the south of Poland.

The number of deaths possibly associated with air pollution with PM$_{2.5}$ was calculated on the basis of the relative risk of mortality and the total annual number of deaths due to the diseases analyzed in this paper. The information about the population count in particular agglomerations was also used for this purpose. Considering the size of the populations in those cities and the total number of deaths from the analyzed causes, the highest number of deaths associated with exposure to PM$_{2.5}$ was observed in Warsaw, Kraków and Łódź. The mean counts for all the analyzed years are presented in Figure 2.

![Figure 1. Annual mean PM$_{2.5}$ concentrations in Polish urban agglomerations in 2006-2011](image-url)

Rycina 1. Średnioroczne stężenia pyłu PM2,5 w aglomeracjach miejskich Polski w latach 2006–2011
Table. Mean relative risk for mortality related to lung cancer, cardiopulmonary diseases, ischemic heart disease and total mortality (non-violent) in the Polish urban agglomerations analyzed in the years 2006-2011

<table>
<thead>
<tr>
<th>City</th>
<th>Lung Cancer</th>
<th>Cardiopulmonary Diseases</th>
<th>Ischemic Heart Disease</th>
<th>Total Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrocław</td>
<td>1.28</td>
<td>1.17</td>
<td>1.45</td>
<td>1.09</td>
</tr>
<tr>
<td>Bydgoszcz</td>
<td>1.36</td>
<td>1.22</td>
<td>1.59</td>
<td>1.11</td>
</tr>
<tr>
<td>Lublin</td>
<td>1.30</td>
<td>1.18</td>
<td>1.47</td>
<td>1.09</td>
</tr>
<tr>
<td>Łódź</td>
<td>1.36</td>
<td>1.22</td>
<td>1.58</td>
<td>1.11</td>
</tr>
<tr>
<td>Kraków</td>
<td>1.69</td>
<td>1.40</td>
<td>2.20</td>
<td>1.19</td>
</tr>
<tr>
<td>Warsaw</td>
<td>1.36</td>
<td>1.22</td>
<td>1.59</td>
<td>1.11</td>
</tr>
<tr>
<td>Białystok</td>
<td>1.27</td>
<td>1.16</td>
<td>1.43</td>
<td>1.08</td>
</tr>
<tr>
<td>Gdańsk</td>
<td>1.27</td>
<td>1.16</td>
<td>1.43</td>
<td>1.08</td>
</tr>
<tr>
<td>Katowice</td>
<td>1.47</td>
<td>1.28</td>
<td>1.78</td>
<td>1.14</td>
</tr>
<tr>
<td>Poznań</td>
<td>1.34</td>
<td>1.21</td>
<td>1.55</td>
<td>1.10</td>
</tr>
<tr>
<td>Szczecin</td>
<td>1.24</td>
<td>1.15</td>
<td>1.39</td>
<td>1.08</td>
</tr>
</tbody>
</table>

Figure 2. Deaths related to the analyzed causes attributable to exposure to PM$_{2.5}$ in Polish urban agglomerations – mean values for the years 2006-2011

Rycina 2. Zgony z analizowanych przyczyn przypisane narażeniu na pył PM2,5 w aglomeracjach miejskich Polski – wartości średnie z lat 2006–2011
These deaths attributable to air pollution with PM$_{2.5}$ per 100,000 inhabitants indicate the scale of the health consequences of exposure to PM$_{2.5}$ in different concentrations. Figure 3 shows the total number of deaths (attributable to pollution with PM$_{2.5}$) from other causes than external, as well as the number of deaths due to cardiopulmonary diseases, ischemic heart disease and lung cancer.

The most frequent cases of deaths caused by exposure to PM$_{2.5}$ are observed in agglomerations with the highest levels of this pollution (Kraków and Katowice). Only slightly fewer cases are observed in Łódź, although this refers mainly to total mortality and deaths caused by cardiopulmonary diseases. By far the lowest frequency per 100,000 inhabitants is observed in Białystok, although considering ischemic heart disease, a slightly lower number of cases is observed in Lublin.

Discussion
The estimates of the total number of deaths unrelated to external causes and the number of deaths due to lung cancer and cardiopulmonary diseases (including ischemic heart disease) attributable to exposure to PM$_{2.5}$ need to be verified in the course of further studies and more detailed analyses. The results were obtained from calculations, during which certain simplifications and assumptions were made that influenced the end result. Of key significance was the assumption that the exposure to PM$_{2.5}$ was equal for all the inhabitants of a given agglomeration. This simplification was caused by the small number of air quality monitoring stations in particular agglomerations (certain agglomerations have only one) and no possibility to refer a specific and different concentration of this pollution to a particular population of a given city. In further analyses it will be possible to use tools for modelling the distribution of PM$_{2.5}$ concentrations in the area of an agglomeration, which will help obtain more reliable results. It must also be emphasized that the calculations used relative risk factors standardized for a single exposure to PM$_{2.5}$ that were taken from studies conducted on North American populations. It is possible that under Polish conditions they could have different values. Since there are no epidemiological studies on this subject in Poland, this hypothesis has yet to be verified.

The results show that, despite simplifications resulting from the limitations of the method and the
limited availability of detailed data, air pollution with PM$_{2.5}$ has a remarkable influence on the number of deaths. In the cities with the highest concentrations of this pollution (Kraków and Katowice), the percentage of deaths attributable to PM$_{2.5}$ is the highest in relation to the total number of deaths.

Considering the generally high concentrations of air pollution in Polish cities, exceeding not only the quite strict recommendations of the World Health Organization with regard to PM$_{2.5}$ concentration but also the more liberal values permitted by EU and national law, it must be noted that the contribution of risk related to air pollution to mortality is relatively high.

Many similar studies conducted in other countries have revealed much lower concentrations of pollution with PM$_{2.5}$. Assessment of the effect of air pollution on mortality in 22 cohort studies conducted in Europe shows that PM$_{2.5}$ concentrations were within the range 6.6 µg/m$^3$ to 31 µg/m$^3$ [13]. In comparison with cities in southern Poland, the scale of exposure in the cohorts is much lower. In these cohorts, the risk of death associated with each 5 µg/m$^3$ increase in PM$_{2.5}$ concentration grew by a factor of 1.07, which indicated that pollution was most strongly related to mortality with regard to all other types of air pollution that were included in the analysis (e.g. PM$_{10}$, NO$_2$, and NO$_x$). Increased risk was observed for lung cancer and strokes, whereas the risk of mortality due to ischemic heart disease and pulmonary diseases remained unchanged. Analyses of the same cohort also showed a statistically significant correlation between an increase in PM$_{2.5}$ concentration and the risk of mortality due to cerebrovascular diseases increasing by 1.21 together with each step increase in PM$_{2.5}$ concentration by 5 µg/m$^3$ [14]. Other studies conducted in the USA showed an increase in the risk of total mortality by 1.06 together with each step increase in PM$_{2.5}$ concentration by 10 µg/m$^3$ [11], whereas in cohort studies conducted in Canada the same increase in PM$_{2.5}$ concentration was associated with an increase in the risk of deaths due to other causes than external by 1.15 and deaths due to ischemic heart disease by 1.31 [15]. The analyses of long-term exposure to pollution with PM$_{2.5}$, covering different parts of the world, including Asian countries [16], showed a 6% increase in the risk of all-cause mortality and an 11% increase in the risk of death due to cardiopulmonary diseases (especially ischemic heart disease). A study known as Harvard Six Cities [17] and another America study involving 36 cities [18] revealed a much higher risk of death due to cardiopulmonary diseases, which was 28% and 76%, respectively, for each increase in PM$_{2.5}$ concentration by 10 µg/m$^3$. British cohort studies did not reveal changes in the risk of death due to cardiopulmonary disease depending on the air quality changes [19]. Shah et al. [20] indicated a slight (1.02) increase in the risk of hospitalization or death due to circulatory insufficiency with an increase in PM$_{2.5}$ concentration by 10 µg/m$^3$.

**Conclusion**

The result presented in this paper are a preliminary attempt to assess the burden of the risk of mortality due to selected diseases in Polish cities, whose occurrence may be related to outdoor air pollution, especially with fine particulate matter. However, the results indicate the need for more detailed analyses of this issue. Due to the high social costs of increased morbidity and premature mortality it is necessary to analyze in greater detail the scale of the effect of outdoor air pollution in Poland on this problem. It may be expected that an adequate detailed diagnosis of the health results of exposure to air pollution will allow implementation of more effective actions to reduce the emission of pollutants and to improve air quality. This requires an increase focus on an integrated environmental health policy.

**Literature**

4. Balmes JR. Can traffic-related air pollution cause asthma? Thorax, 2009; 64: 646-647
of 22 European cohorts within the multicentre ESCAPE project. Lancet, 2014; 383 (9919): 758-760
Influence of organic dust on the respiratory system

Wpływ pyłów organicznych na układ oddechowy

Tadeusz M. Zielonka
Chair and Department of Family Medicine, Medical University of Warsaw; head: Prof. Kazimierz A. Wardyn MD, PhD

This article is based on a lecture of the same title presented at the 5th Scientific Conference in honor of Brig. Gen. Wojciech Lubiński MD, PhD, Assoc. Prof. "The impact of air pollution on health" on 24 April 2015 at the Military Institute of Medicine in Warsaw

Abstract. Exposure to organic dust may induce a wide spectrum of upper and lower respiratory tract chronic disorders such as: rhinitis, sinusitis, mucous membrane inflammation syndrome, asthma, asthma-like syndrome, hypersensitivity pneumonitis, organic dust toxic syndrome (ODTS), chronic bronchitis, and chronic obstructive pulmonary disease. Organic dust is a complex mixture of a variety of substances that includes dust particles of various sizes, of which microbial cell wall components (endotoxins and peptoglycans) form an important part. Aeroallergens are also a hazardous part of organic dust, and are capable of inducing IgE immune responses and provoking allergic reactions in sensitized subjects. Respiratory symptoms recorded following exposure to organic dust (wheezing, dyspnea and cough) are non-specific and can be associated with several respiratory disorders. Personal respiratory airway protection proves efficient in avoiding the development of respiratory diseases. These diseases are also preventable by controlling harmful exposure to organic dust, toxic gases and chemicals on farms through improvements in animal rearing techniques, in particular in ventilation of animal accommodation, careful drying and suitable storage of animal feedstuffs, crops and other agricultural products.

Key words: air pollution, organic dust, asthma, extrinsic allergic alveolitis, organic dust toxic syndrome, chronic bronchitis, rhino-sinusitis

Streszczenie. Narażenie na pyły organiczne wywołuje szerokie spektrum przewlekłych chorób górnego i dolnego odcinka układu oddechowego, takich jak zapalenie nosa i zatok, zespół zapalenia błon śluzowych, astma, zespół astmopodobny, alergiczne zapalenie pęcherzyków płucnych, toksyczny zespół narażenia na pyły organiczne, przewlekłe zapalenie oskrzeli, POChP itp. Pył organiczny jest złożoną mieszaniną różnorodnych substancji, zawiera cząstki o różnej średnicy, wśród których szczególnie ważne są składniki ściany komórkowej bakterii (endotoksyny i peptoglikany). Równie groźnym składnikiem powietrza są alergeny wziewne, makrocząsteczki wywołujące u osób wrażliwych IgE-залęną odpowiedź immunologiczną. Objawy oddechowe u osób narażonych na pyły organiczne (świsty, duszność i kaszel) są nieswoiste i mogą występować w przebiegu wielu chorób. Osobista ochrona dróg oddechowych jest skutecznym sposobem uniknięcia rozwoju chorób układu oddechowego. Można również zapobiegać tym chorobom, zmniejszając narażenie na szkodliwe pyły i gazy organiczne oraz toksyczne substancje chemiczne w gospodarstwie rolnym poprzez odpowiednie technologie stosowane w hodowli zwierząt, a zwłaszcza właściwą wentylację pomieszczeń, staranne suszenie i odpowiednie przechowywanie pasz, roślin i innych produktów rolniczych.

Słowa kluczowe: zanieczyszczenie powietrza, pyły organiczne, astma, alergiczne zapalenie pęcherzyków płucnych, toksyczny zespół narażenia na pyły organiczne, przewlekłe zapalenie oskrzeli, zapalenia nosa i zatok

Delivered: 05/10/2015
Accepted for print: 01/12/2015
No conflicts of interest were declared.
Copyright by Military Institute of Medicine

Introduction
Exposure to organic dust in the agricultural environment may cause intense airway inflammatory responses, and constant exposure can lead to a chronic diseases [1]. As a result of the exposure to dust, symptoms such as cough and dyspnea, as well as deterioration of respiratory function occur [2]. Inhalation of organic dust causes a variety of diseases of the upper and lower respiratory tract. The most important of them (asthma, allergic rhinitis and extrinsic allergic alveolitis (EAA)) are allergic in nature. Non-allergic diseases caused by organic dust include: organic dust toxic syndrome (ODTS), muco-sitis, chronic bronchitis, chronic obstructive pulmonary disease (COPD) and asthma-like syndrome. Inhalation of organic dust can cause acute, rapidly progressive and chronic and insidiously
progressive respiratory symptoms. Various pathomechanisms are possible for disorders of the airway: allergic (IgE-dependent), immunological after sensitization to an antigen, as well as toxic, with the cell reaction to microorganisms and other organic products. The same organic factors can cause a different response. Examples include fungal spores, which in some people may cause asthma, EAA, or even organic dust toxic syndrome. It is probable that genetic factors decide which type of immune response develops in an individual, and the same antigens can result in disorders in different airway areas. In some patients, due to organic antigens (e.g. fungal spores, endotoxins), changes develop in the upper respiratory tract (rhinitis), in the bronchi (asthma), or in the alveoli (EAA). After cessation of exposure, permanent abnormalities in the respiratory system are not always found in patients with asthma or allergic rhinitis. In EAA patients, inhalation of allergens can cause irreversible damage to the lungs. The inhalation of organic dusts may also exacerbate existing illnesses, such as asthma or COPD, even if they are not their cause.

**Organic factors harmful to the respiratory system**

Disorders in the respiratory tract can be caused by various organic factors: allergens, organic dust, endotoxins, peptidoglycans and gases [3]. They activate a variety of immune cells and can trigger a variety of receptor signaling pathways [4].

**Allergens**

Among the environmental factors that can cause respiratory system disorders, a prominent place is taken by allergens. These protein antigens are large molecules that can trigger an immune response induced by IgE antibodies (type I according to Gell and Coombs), resulting in a characteristic allergic reaction. The most significant inhaled allergens include pollen (grass, cereal and tree pollen), mites, fungi spores (especially mold spores), animal hair (cat, dog, horse, hamster, mouse, rat and guinea pig hair, etc.), and insect debris (e.g. cockroach debris) [5].

**Organic dust**

Organic dust is a mixture composed of a broad range of substances, among which the constituents of bacterial cell walls are particularly important. It contains particles of different sizes: half of them (40-60%) being particles 4 μm (or less) in diameter, which are inhaled into the lower respiratory tract and alveoli [5]. Particles with a diameter of 4 μm result in a stronger inflammatory response than smaller (2 μm) and larger particles (10 μm) [6]. Equally important in the pathogenesis of diseases is the concentration of organic dust. If it exceeds 2.5 mg/m³ in a poultry unit, and 0.16 mg/m³ in a poultry unit, agricultural workers experience significant deterioration in lung function (FEV1 reduction) [7].

**Endotoxins**

Organic dust contains endotoxins are derived from the cell walls of Gram-negative bacteria. Inhalation or intravenous administration of lipopolysaccharides, comprising the bacterial cell membranes and classified as endotoxins, causes inflammation with fever, sweating, flu-like symptoms, cough, dyspnea, chest tightness and leukocytosis with worsening lung function (bronchial obstruction and impairment of gas diffusion) in humans [8]. Sustained exposure to endotoxins increases the risk of ODTS and chronic bronchitis, but also fulfills a protective role in the development of allergic diseases [8].

**Peptidoglycans**

It is not only endotoxins that play an important role in the development of airway inflammation after exposure to organic dust, as Gram-positive bacteria also cause inflammation of the alveoli and respiratory epithelium [9]. The participation of peptidoglycans, the cell wall components of anaerobic Gram-positive bacteria, have been demonstrated and are present in the organic dusts in piggeries [10]. The main example is muramic acid, whose increased concentration in air correlates with the inflammation of the bronchial mucosa in pig breeders [11]. Exposure to peptidoglycans triggers the release of inflammatory mediators and the development of inflammation [11].

**Gases**

The breeding of large animals leads to the release of significant amounts of gases as by-products of animal waste, especially manure. The most important of these is hydrogen sulfide, which in high concentrations can cause pulmonary edema, loss of consciousness and even death. In low concentrations it is detectable and has a smell like rotten eggs, but in high concentrations it becomes undetectable due to the loss of the sense of smell [5]. Chronic exposure to these gases causes sinusitis, COPD and the decline in FEV1 [12].

**Bronchial asthma**

Asthma is a chronic inflammatory disease of the airways characterized by diverse recurrent symptoms such as wheezing, dyspnea, chest tightness and cough, occurring especially at night or in the morning, with...
airway hyper-responsiveness and bronchial obstruction, which regresses spontaneously or under the influence of treatment [13]. The morbidity of asthma continues to increase and the disease has become one of the most important epidemiological problems. Today, it is the most common chronic disease in children. In Western Europe, the morbidity of asthma has doubled in the last decade [14], and in Poland nearly 6% of adults and 9% of children suffer from asthma [15], while in some countries this figure reaches 30% [13].

Both atopic (IgE-dependent) and non-atopic (IgE-independent) asthma exist [13]. In atopic asthma, symptoms occur when allergens of organic origin are inhaled, such as pollens, mold spores, animal hair and insect or mite debris [13].

Although asthma is associated with exposure to organic allergens, allergy and IgE-dependent asthma are less frequently observed in children brought up in the countryside [16]. According to the hygiene hypothesis introduced by Strachan, the restriction of infections in young children promotes the development of atopy [17]. Exposure to endotoxins or other bacterial components present in the agricultural environment causes a reduction in the development of IgE-mediated asthma [18]. This is confirmed by large studies among European children (GABRIEL and PARSIFAL), which showed an inverse relationship between the exposure of children to microorganisms on the farm and the incidence of atopy and asthma [19]. Despite these observations, there are reports related to the increasing incidence of IgE-independent asthma in children and adults living in rural areas [20]. It is suggested, however, that this disease is under-diagnosed in rural environments [16]. The incidence of asthma among farmers is increased in smokers [21].

The most important causative agents of occupational asthma include organic dust such as flour and grain, wood dust, diisocyanates, natural rubber latex, etc. [13]. In farmers, a 2.5-fold increase in the incidence of occupational asthma has been observed [22].

In people exposed to organic dusts, an asthma-like syndrome was described characterized by coughing, tightness in the chest, dyspnea and wheezing, but no functional disorders of the lungs, eosinophilia and chronic inflammation, but with a positive result for bronchial hyperresponsiveness [23].

### Extrinsic allergic alveolitis

EAA is an allergic reaction to organic dusts in the lower airways other than asthma. Inhalation of airborne organic allergens in susceptible individuals elicits a type III or IV response (Gell and Coombs) [24]. Alveolitis resulting from hypersensitivity is induced by antigens specific for given people, which elicit the formation of antibodies of a precipitin type. The interstitial character of the disease distinguishes HP from other diseases developing due to organic dust. Consequently, development of diffuse inflammatory lesions takes place and granulomas form in the distal airways and lung parenchyma [25]. The disease was initially found in farmers working with moldy hay in the 1960s. With time, the occurrence of similar symptoms were described in other professions in which there was exposure to organic dust in the workplace (Table 1). It is now known that exposure to organic allergens and EAA formation can also occur at home (Table 2). The list of organic allergens that cause the disease and descriptions of new EAA forms continues to grow.

Depending on the severity of exposure and genetic predisposition, the disease has a diverse course – from mild and limited to diffuse, fast-moving lesions that can lead to death [26]. The disease may proceed in an acute, subacute or chronic form [26]. An acute reaction develops after 4-8 hours of high exposure to the organic allergen (e.g. work in a barn or pigeon loft). Symptoms develop quickly and have a flu-like nature or resemble atypical pneumonia. Patients complain of fever, chills, muscle aches, malaise, dyspnea and cough. Contrary to infections, fever in EAA lasts several hours and does not recur. What is noteworthy in the physical examination is: rapid breathing and crackles at the base of the lung, while wheezing is rarely heard. Sometimes there is bleeding into the alveoli with hemoptysis, hypoxemia and cyanosis [27]. The symptoms subside within a few days, but return after the next exposure to organic dust.

A chronic form of EAA is very difficult to diagnose because symptoms such as weight loss, fatigue and fever are uncharacteristic, and the course of the disease is slow.
Table 1. Hypersensitivity pneumonitis in workplace

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Exposure</th>
<th>Disease entity</th>
</tr>
</thead>
<tbody>
<tr>
<td>farmers</td>
<td>moldy hay</td>
<td>farmer’s lung</td>
</tr>
<tr>
<td>mushroom growers</td>
<td>fungal spores, moldy compost</td>
<td>mushroom grower’s lung</td>
</tr>
<tr>
<td>poultry breeders</td>
<td>droppings of chickens, geese, ducks, turkeys</td>
<td>bird breeder’s lung</td>
</tr>
<tr>
<td>millers</td>
<td>insects</td>
<td>miller’s lung</td>
</tr>
<tr>
<td>cork processing workers</td>
<td>cork dust</td>
<td>suberosis</td>
</tr>
<tr>
<td>woodcutters</td>
<td>wood dust</td>
<td>sequoiosis, woodcutter’s lung</td>
</tr>
<tr>
<td>woodworkers</td>
<td>wood dust</td>
<td>woodworker’s lung</td>
</tr>
<tr>
<td>winemakers</td>
<td>moldy grapes</td>
<td>winemaker’s lung</td>
</tr>
<tr>
<td>brewers</td>
<td>moldy malt</td>
<td>brewer’s lung</td>
</tr>
<tr>
<td>sugar industry workers</td>
<td>moldy sugar cane</td>
<td>bagassosis</td>
</tr>
<tr>
<td>milk processing workers</td>
<td>blue cheeses</td>
<td>cheese worker’s lung</td>
</tr>
<tr>
<td>paprika workers</td>
<td>powdered paprika</td>
<td>paprika slicer’s lung</td>
</tr>
<tr>
<td>cigarette workers</td>
<td>tobacco leaves</td>
<td>tobacco worker’s lung</td>
</tr>
<tr>
<td>tea workers</td>
<td>tea leaves</td>
<td>tea worker’s lung</td>
</tr>
<tr>
<td>coffee workers</td>
<td>coffee beans</td>
<td>coffee worker’s lung</td>
</tr>
<tr>
<td>fish meal workers</td>
<td>fish meal</td>
<td>fish meal worker’s lung</td>
</tr>
<tr>
<td>seafood workers</td>
<td>shrimp</td>
<td>shrimp processing worker’s lung</td>
</tr>
<tr>
<td>furriers</td>
<td>animal hair</td>
<td>furrier’s lung</td>
</tr>
<tr>
<td>builders</td>
<td>rotting moss</td>
<td>thatched roof disease</td>
</tr>
<tr>
<td>fruit-growers</td>
<td>insecticides</td>
<td>plant sprayer’s lung</td>
</tr>
<tr>
<td>detergent workers</td>
<td>bacterial enzymes</td>
<td>detergent worker’s lung</td>
</tr>
<tr>
<td>chemical industry workers</td>
<td>polyurethane foams, plastics, paints, adhesives</td>
<td>chemical worker’s lung</td>
</tr>
<tr>
<td>operators of water equipment: fountains, baths, or swimming pools</td>
<td>contaminated water aerosol</td>
<td>hot tub lung, tap water lung</td>
</tr>
<tr>
<td>operators of cutting and grinding machines</td>
<td>grinding dust aerosol</td>
<td>grinder’s lung</td>
</tr>
</tbody>
</table>

With time, progressive dyspnea and productive cough appear, whose occurrence the patient does not associate with long-term exposure to the antigen (e.g. proteins of birds bred in the home). This form develops in people with constant exposure to small amounts of the allergen. The diagnosis in these cases is usually determined only on the basis of a histopathological examination of the lungs [25]. Lung biopsy is performed after detection of significant radiological changes [25].

An intermediate form of the disease involves subacute cases that occur after moderate and repeated exposure to organic allergens [26]. They usually have the form of mild symptoms of the acute form. Patients complain of transient short-term low-grade fever, mild chronic cough and respiratory discomfort. Sometimes the dominant symptom is progressive exertional dyspnea with periods of exacerbation after contact with the allergen.

In contrast to other diseases developing due to exposure to organic dusts, in EAA there are visible diffuse lesions in the radiographic image of the lungs. They have an interstitial character, initially
reticulonodular, and eventually fibrous, and are located mainly in the central and upper lung fields [25]. In assessing the nature, location and dynamics of these lesions, a high-resolution CT scan is helpful [25]. In the course of EAA, various functional disorders of the respiratory system, typical of interstitial lung diseases, can be observed, such as restrictive lung disease, diffusion impairment, decreased lung compliance, exertional hypoxemia and increased alveolar-arterial oxygen gradient. The disease belongs to the group of rare interstitial lung diseases in which airflow obstruction can be found [28].

The most characteristic features of EAA is the occurrence of typical recurrent clinical symptoms after 4-8 hours from inhalation of organic dust, loss of weight, audible crackles over the lungs, and detection of specific precipitating antibodies in the serum [29]. Schuyler and Cormier [30] proposed determination of EAA diagnosis using the evaluation of the large and small criteria of the disease, determining at least 4 large and 2 small criteria. The large criteria include: exposure to the organic antigen, detection in the serum or bronchoalveolar lavage fluid (BALF) of specific antibodies, typical clinical symptoms, characteristic radiological changes, increase in the number of lymphocytes in BALF, characteristic histological changes and a positive result of a challenge test. Small diagnostic criteria involve: bilateral crackles at the base of the lungs, gas diffusion impairment and hypoxemia (at rest or in exertion).

Organic dust toxic syndrome
Reactions to the dust of organic origin is not always allergic in nature. After inhalation of dusts containing a large number of micro-organisms, a toxic response may develop, known as organic dust toxic syndrome (ODTS). This is a flu-like disease occurring in farmers exposed to organic dusts [31]. It is caused by endotoxins and mycotoxins, which trigger the release of inflammatory mediators. It was found for first time in 1986 under the name of mycotoxicosis in people unloading silos [32]. Since then, ODTS has been described, including exposure to various organic dusts [33]. Because it does not involve an individual allergic reaction, it occurs much more frequently than EAA [34]. ODTS was found most often in people working with compost [35]. In the United States, it was observed in 12-34% of the people exposed on a long-term basis to the organic dusts contained in leaf litter [3, 31].

It is a non-infectious disease with fever, sweating, malaise, muscle pains and headache, nausea, dry cough, dyspnea and tightness in the chest [3, 33]. Symptoms appear several hours after exposure [3]. A physical examination usually does not show significant irregularities, but hyperventilation is detected, and also inspiratory crackles can be heard [35]. The radiological image of the chest is usually normal [12, 33], although the appearance of parenchymal infiltration has been reported [35]. In some cases, airflow obstruction can be found in spirometry, and an increase in levels of inflammatory markers (WBC, CRP) and hypoxemia are observed in laboratory tests [12]. Inflammation of the bronchial mucosa is visible in the bronchoscopy, and in BALF, similarly as in EAA, an increase in the percentage of neutrophils in the acute phase, and later lymphocytes [12]. The clinical picture and the results of additional tests are similar to acute EAA [34]; however, antibodies against the organic allergens which caused the reaction are not found in the serum. Radiography does not reveal changes typical of EAA, and severe hypoxemia is rarely found. The disease also does not lead to pulmonary fibrosis nor functional disorders typical of chronic extrinsic allergic alveolitis [34]. Within the 24 hour period after the end of exposure, spontaneous recovery occurs, but the symptoms may subside within a few days [3]. Although total self-restraint is characteristic of this disease, an increased risk of developing chronic non-allergic bronchitis has been reported [36]. A typical feature of this syndrome is massive exposure to organic dusts and the short period between exposure and the onset of flu-like symptoms.

Chronic bronchitis and COPD
In farmers and people exposed to organic dust, there is an increased risk of morbidity and mortality due to chronic bronchitis defined as chronic cough for 3 months during the last two years and COPD, where there is also poorly reversible airway obstruction [22]. In people who have never smoked tobacco, the risk of developing COPD is more than 3 times higher in the case of occupational exposure to gases, fumes or dusts [37]. In Denmark, it has been found that COPD develops under the influence of the inhalation of organic dusts, but a similar effect has not been shown for inorganic dusts [38]. A large literature review indicates, however, that both organic and inorganic dust can cause COPD [39]. Among Danish pig breeders, chronic bronchitis was found in 32% of workers, 28% among cattle farmers, and 18.6% for farmers who do not breed animals [22, 40].

Livestock farmers and milk producers have a significantly increased (by 30-40%) risk of developing COPD [22]. Among livestock farmers, not only chronic bronchitis and COPD but also worse pulmonary functions are much more prevalent than in farmers growing cereals and other plants [22]. These changes in non-smoking farmers are caused primarily by the inhalation of ammonia and hydrogen sulfide [21]. The
association between the occurrence of COPD in non-smoking farmers and exposure to dusts and endotoxins has been found [41]. An important cause of COPD in the rural population in developing countries is burning biomass in households [42]. Occupational exposure to organic dusts also increases the risk of bronchial carcinoma [43].

**Upper respiratory tract diseases**

Allergic and non-allergic rhinitis and sinusitis are very common diseases in people exposed to organic dust [5, 44]. In two-thirds of farmers, acute rhinitis was reported, and in almost 40% of them at least three rhinitis episodes were recorded per year [44]. In patients exposed to organic dusts, acute or chronic inflammation of the nasal mucosa is often accompanied by symptoms in the form of nasal congestion, watery runny nose and sneezing. In the nasal lavage fluid of pig breeders after occupational exposure, an increase has been found in neutrophil counts and concentrations of IL-8 and IL-6 [45].

Allergic rhinitis is one of the most common diseases nowadays. In the study of the EADP (Epidemiology of Allergic Diseases in Poland), allergic rhinitis was found on average in 36.1% of the study population (from 24.5% in the age group 13–14 years to 37.8% in the age group 6–7 years) [46]. The incidence of rhinitis in the rural region is lower than the average in urban residents (22.9% vs. 37.7%) [46]. In comparison with other countries, Poland belongs to the group of most allergized societies, especially in the younger age groups.

In the vast majority of cases, allergic rhinitis is caused by allergy to organic airborne allergens, such as grass pollens, grains and trees, fungal spores, mite debris, etc. Allergic rhinitis, pollinosis and seasonal allergic rhinitis are defined as symptomatic rhinitis caused by an IgE-mediated reaction resulting from contact with an allergen (mainly pollens), which may occur with the associated attacks of asthma or allergic reactions of the skin [47]. Typical symptoms of this disease include runny nose, nasal congestion and itching as well as sneezing that regress spontaneously or after treatment.

In individuals exposed to organic dust, mucosal inflammatory disease has also been reported, which is characterized by symptoms associated with the nose, eyes and throat. The disorder has been especially often described in reference to piggery workers [5]. In the course of this reaction, an increase has been found in the concentrations of IL-1α, IL-1β and IL-6 in the nasal lavage fluid [12].

**Prevention**

An important element in preventing the development of diseases of the respiratory system is reducing exposure to the organic dusts harmful to health. This can be achieved by improving the ventilation of residential and workplace environments, which applies especially to agriculture where there is a particularly large exposure to organic dust. Equally important is the use of heating systems restricting the growth of mold, actinomycetes, in the workplace or in the home. Proper maintenance and frequent replacement of water in air conditioning systems prevents respiratory diseases. It is also important to control the presence of potential antigens in the workplace, especially in the water or in the air, and to take appropriate measures in case of increased workers’ exposure to organic antigens. For 25 years, the Allergen Research Center has been preparing information about the current and projected concentrations of pollen in Poland. This information is published on the websites www.odetchnijspokojnie.pl and www.tvmeteo.tvn24.pl/alergia as well as in TVP programs. This allows patients to undertake rational actions, avoid excessive exposure and modify their treatment. It is also helpful to use personal protection at work (masks with HEPA filters) – they have significantly reduced the development of many diseases [48]. Of large significance is good practice in agricultural production, reducing the number of microorganisms. Healing the environment may provide better results than the treatment of patients.

**Literature**

Influence of organic dust on the respiratory system

GENERAL WOJCIECH LUBIŃSKI 5TH SCIENTIFIC CONFERENCE

32. May JJ, Stallones L, Darrow D, Pratt DS. Organic dust toxicity (pulmonary mycotoxicosis) associated with silo unloading. Thorax, 1986; 41: 919-923
42. Ezzati M. Indoor air pollution and health in developing countries. Lancet, 2005; 366: 104-106
Spirometry Days as an educative element on the causes, course and consequences of asthma and chronic obstructive pulmonary disease

Dni Spirometrii jako element edukacji w zakresie przyczyn, przebiegu oraz skutków astmy oskrzelowej i przewlekłej obturacyjnej choroby płuc

Abstract. Obstructive lung disease affects more than 6,000,000 people in Poland, but only half of them know about their disease. Spirometry Days are an initiative aimed at educating society about the causes and the identification of obstructive diseases, but it is also a project intended to improve the diagnosis of asthma and COPD. This article is a summary of the educational effects of Spirometry Days and an analysis of the results of the Second Polish Spirometry Days. The analysis of the research material involved the results of 1187 pulmonary function tests conducted in 26 cities in Poland. The subjects also completed a questionnaire which was then evaluated. In the study group (n = 1102), 234 cases of bronchial obstruction were documented (19.7%), and a significant part of the group (63.6%) were people who underwent a lung function test for the first time in their life. Among the respondents with airflow obstruction, dyspnea was reported by 39.7%, dry cough by 23.5%, productive cough by 38.9% and wheeze by 22.7%. Obstruction was documented among 11.8% of rural areas residents, 17.4% among the inhabitants of towns with a population <100,000 and 22.8% among the inhabitants of cities with a population ≥100,000. The comparison of the test results concerning the distance between dwelling place and a busy street indicated a significant negative impact of traffic on the efficiency of the respiratory system. The research showed that a significant percentage of people with symptoms of respiratory disease had never experienced a pulmonary function test. There is a correlation between living in a large city close to a busy road and the risk of bronchial obstruction. Initiatives like Spirometry Days increase public awareness of respiratory diseases, their causes, factors increasing exposure to disease, the course of the disease and related complications.

Key words: Spirometry Days, asthma, chronic obstructive pulmonary disease, air pollution, education
Obstructive lung diseases (asthma and COPD) are today some of the most serious health problems, and it is estimated that approx. 4 million people in Poland have asthma, while over 2 million suffer from POCD [1, 2]. Unfortunately, over 50% of those suffering from asthma and as many as 80% of people with COPD have not been diagnosed, and therefore do not receive proper treatment. In the case of COPD it has serious consequences, as a lack of treatment results in the shortening of the lifespan by 10 years in people who are diagnosed late [3]. As the early diagnosis of COPD is very important it inspired the idea of the World Spirometry Days and National Spirometry Days. They are aimed primarily at presenting the problem of respiratory diseases to society, especially their causes, course and effects, as a lack of adequate knowledge may result in the irreversible progression of the disease. The risk factors in COPD are both environmental and innate (genotype). Development of the disease is associated with smoking, but also with increased exposure to air pollution [4]. The most significant risk factor in COPD is smoking tobacco; however, the disease also affects subjects who never smoked [5]. It has been estimated that they may account for 19-35% of all the COPD patients in the world [6, 7]. Exposure to air pollution in the workplace is probably a factor in 19% of COPD cases, and up to 33% among people who never smoked tobacco [3]. Therefore, it is important to consider exposure to different risk factors in epidemiological studies on the development of obstructive lung diseases. Numerous studies confirm that exposure to pollution, including traffic pollution, affects human health, such as by disturbing proper respiratory function [8-12].

Population studies demonstrate that COPD, depending on the country, affects 8-10% of people over 30 years old [13], which is confirmed by studies conducted in Poland where signs of bronchial obstruction [14] were found in 10% of people over 40 years old. Also significantly lower values of spirometric parameters were observed in the group of city residents, compared to people living in areas of low air pollution concentration [15].

The risk of COPD and its health effects resulted in the creation of the Global Initiative for Chronic Obstructive Lung Disease (GOLD). One of the goals behind the initiative was to prepare a global strategy for the diagnostics, treatment and prevention of POCD in order to improve the management and prophylaxis of the disease. Romain et al. [4] emphasized the importance of educating patients and medical personnel on COPD, and making both groups aware that dyspnea, chronic cough and expectoration are symptoms of a disease, and their causes need to be found.

In the years 2002-2005, Norwegian citizens annually responded to an enquiry about whether they had ever heard about COPD. At the beginning, 27% of respondents gave positive answers, whereas in the last questionnaire this had risen to 78% [16]. The most significant increase in awareness was observed in women, people over 40 years old, those with a yearly income over 60 thousand euros, and those having higher education. The success in increasing social awareness was obtained in cooperation with the Norwegian Heart and Lung Association, and a strategic group of medical organizations for COPD. Their activities were intensified during the annual Spirometry Days. The next step for Norway was adopting a national strategy for COPD in 2006-2011.

In Poland a number of scientific associations (Polish Respiratory Society - PTChP and Polish Allergy Association - PTA) and patients’ organizations were grouped under the Polish Federation of Asthma, Allergy & COPD Patients’ Associations, which is currently trying to motivate the government to develop and adopt a national program for COPD prevention and treatment. The International COPD Coalition (ICC) also conducts actions raising awareness of COPD among citizens. Grouse and Nonikov [17] summarized the previous achievements of ICC in this field: the first results from 2001 revealed a very limited global awareness of COPD, from 4% in Brazil to 10% in Germany. Presently, the coalition comprises many countries which regularly conduct survey studies. The results of the last survey, organized in 41 countries (26 developed countries and 15 developing countries), indicate a significant improvement. In nearly 37% of the countries public awareness of COPD was at least 20%, while in 31% of the developed countries under the study the awareness was over 40%. Unfortunately, none of the developing countries participating in the survey demonstrated such good results. According to a study prepared for the
Polish Respiratory Society by the Centre for Public Opinion Research, COPD awareness in Polish society was only 6% [18].

World Spirometry Days were initiated by the European Lung Foundation and European Respiratory Society in 2010, as one of the Lung Year events. The celebrations in Poland were coordinated by the Polish Respiratory Society and Polish Federation of Asthma, Allergy and COPD Patients Organizations. Medical centers declared their participation on a voluntary basis, each of them undertaking to perform spirometric tests free of charge for interested people visiting the center. Before the test, the subject was asked to complete a questionnaire, while anyone whose spirometric test revealed an obstructive ventilation disorder received a letter for a doctor requesting further diagnostics in order to confirm or exclude obstructive lung disease. During this action subjects also received information about the adverse effects of smoking tobacco, and about the diagnosis, prophylaxis and treatment of obstructive lung diseases.

The aim of our study was to summarize the educational outcomes of the Spirometry Days, and to analyze in detail the results of the surveys and spirometric tests collected during the second edition of Polish Spirometry Days.

Material and methods
During three editions of the world Spirometry Days and two National Spirometry Days, over 30,000 people were examined in Poland. In more than 6,000 (approximately 20% of the people tested) pulmonary ventilation disorders were observed. This article presents the data from the 2nd Polish Spirometry Day in 2013.

Due to the incomplete data in the questionnaires delivered by the centers participating in the event, and the failure to fulfill the technical conditions of a spirometric test determined by the Polish Respiratory Society (PTChP) [19], a large part of results was not suitable to be included in the analysis. As many as 50% of the spirometric test results could not be interpreted due to non-compliance with the technical conditions required for test reliability. After all the exclusions, the analysis was based on the results of 1,187 spirometric tests.

The spirometric tests were conducted in 26 locations in Poland. The people tested also completed a questionnaire which provided information about previous chronic respiratory diseases, chronic symptoms, respiratory disorders, allergies, place of residence, living conditions and lifestyle, smoking, physical activity, type of work etc. Based on the information from the questionnaires, the test subjects were allocated to three types of location: rural areas, towns with a population under 100 thousand, and cities with a population over 100 thousand people. The majority of people tested (55.1%) lived in cities, the least number lived in a rural area (9.3%), while town residents accounted for 35.6% of the people tested.

The analysis also included the distance between the place of living and the edge of the closest busy street. People were classified into groups of those living within or over 50 m, and those over 100 m from the street.

A spirometric test was recommended especially in people who smoked cigarettes, reported chronic cough and expectoration, were exposed to passive tobacco smoking or environmental risk factors affecting the respiratory system.

Each test comprised two parts:
- questionnaire, with the main goal to provide information about health problems,
- spirometric test, performed in a sitting position (in some cases the subject was standing), with straight back, after receiving instruction regarding proper performance of the test; the exam was repeated at least three times, and the flow-volume curve was recorded, until the results achieved repeatability according to the ATS and ERS criteria (individual test results could not differ more than by 5%) [17]; the test result included the following variables:
  - FVC – forced vital capacity,
  - FEV₁ – forced expiratory volume in one second,
  - PEF – peak expiratory flow,
  - FEV₁/FVC – a ratio of FEV₁ to FVC, also called a pseudo-Tiffeneau factor.

The diagnostic criterion for obstruction was reduction in the FEV₁/FVC ratio below the lower limit of normal, or below the 5 percentile of the proper value. Considering the age of the subjects, reduction in the FEV₁/FVC ratio below 0.7 was a criterion used in the study, despite risking overdiagnosis of obstruction in patients over 60 years old. The results expressed in dm³ were standardized according to ERS/ECCS guidelines [19]. Statistical analysis was performed using STATISTICA 10 software.

Results
The educational value of the Spirometry Days resulted from the dedication of the organizers in providing the media (and thus society) with information about the diagnosis, prophylaxis and treatment of asthma and COPD. In 5 years, over 1,000 media reports concerning respiratory function, asthma and COPD tests occurred in the press, on television and on the radio.
 Spirometry Days as an educative element on the causes, course and consequences of asthma and chronic obstructive pulmonary disease

The number of publications increased in the following years (Table 1). The mean age in the study group was 54.7 ± 16.5 years. In the analyzed group (n = 1,102) 234 cases of bronchial obstruction (19.7%) were documented, including 96 subjects with mild disease (8.1%), 105 subjects with moderate disease (8.8%), 16 subjects with serious disease (1.3%) and 6 subjects with very serious disease (0.5%). The mean pseudo-Tiffeneau factor was 77.2 ± 11.4%, and mean FEV1 value was 92.6 ± 22%. The majority of the group (63.6%) were people who received a pulmonary function test for the first time, and in this group bronchial obstruction was found in 17.8% of subjects.

Some subjects declared that they had been diagnosed with obstructive respiratory disease, but never underwent a spirometric test. This group comprised 26 cases of asthma and 12 cases of COPD. There was also a discrepancy between the number of subjects who declared having an obstructive respiratory disease, and the number of subjects whose spirometric test revealed ventilation disorders. A diagnosis of asthma or COPD was reported by 110 subjects, but the spirometry results confirmed obstruction only in 24.4% out of 41 people who declared having COPD, and in 32% out of 75 subjects who declared having asthma. In 18.5% of the 1,067 subjects who were not diagnosed with an obstructive disease, obstruction was observed in the spirometric test.

The analyses also involved the occurrence of chronic symptoms from the respiratory system, persisting for over 12 weeks. Among the subjects with normal spirometric test results (n=953) 32.2% reported dyspnea, 24.1% reported dry cough, 29.9% reported productive cough with expectoration, and 16.7% reported wheezing. Among 234 subjects whose function test confirmed bronchial obstruction (n=234), dyspnea was reported by 39.7% of the subjects, dry cough by 23.5%, productive cough by 38.9%, and wheezing by 22.7%. A significant number of the subjects with the above symptoms had never had a spirometric test 2).

The results of the spirometric test according to the place of residence were also analyzed. Considerable differences between the results of spirometric tests in the three assessed groups of subjects were observed (Table 3). The best respiratory efficiency was found in the residents of rural areas, and the difference between them and the residents of the cities was statistically significant. This trend is also confirmed by the number of diagnosed obstruction cases: 11.8% were rural area residents, 17.4% were subjects from towns of under 100 thousand citizens, and 22.8% were people from cities with a population of over 100 thousand. Comparison of the results of the function test according to the distance between the testing site and a busy street indicates a possible adverse effect of traffic, especially traffic-related air pollution, on the respiratory system efficiency. The presented results pertain only to non-smokers, who are not directly exposed to the harmful effects of tobacco smoke (Table 4). A relationship between living in a city (≥100 thousand citizens), near a busy street (<50 m) and ventilation disorders can be seen. Out of 131 subjects in this group, 28.2% were diagnosed with bronchial obstruction. The smallest amount of people with bronchial obstruction was found in towns, among those living ≥50 m (14.6%) or ≥100 m (15.9%) away from a busy road.

**Discussion**

The study demonstrates that for a large proportion of subjects presenting respiratory symptoms a spirometric test was never performed, despite medical indications. This varied from 15.3% in subjects reporting persistent wheezing to 33.1% in those reporting chronic dyspnea. The results presented are not representative of a whole population; however, it is worth emphasizing that a large group of subjects are completely unaware of their health problems, for whom a screening respiratory function test would be advisable.

---

**Table 1. Number of media reports related to Spirometry Days**

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Publications</th>
</tr>
</thead>
<tbody>
<tr>
<td>World Spirometry Day 2010</td>
<td>140 publications</td>
</tr>
<tr>
<td>Polish Spirometry Day 2011</td>
<td>180 publications</td>
</tr>
<tr>
<td>World Spirometry Day 2012</td>
<td>230 publications</td>
</tr>
<tr>
<td>Polish Spirometry Day 2013</td>
<td>210 publications</td>
</tr>
<tr>
<td>World Spirometry Day 2014</td>
<td>260 publications</td>
</tr>
</tbody>
</table>

**Table 2. Percentage of subjects with and without bronchial obstruction, not tested previously and declaring ailments of the respiratory system**

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>With bronchial obstruction</th>
<th>Without bronchial obstruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>dyspnea</td>
<td>37.9%</td>
<td>32.2% (p &lt; 0.5)</td>
</tr>
<tr>
<td>dry cough</td>
<td>23.5%</td>
<td>24.1% (p &lt; 0.5)</td>
</tr>
<tr>
<td>productive cough</td>
<td>38.9%</td>
<td>29.9% (p &lt; 0.5)</td>
</tr>
<tr>
<td>wheezing</td>
<td>22.7%</td>
<td>16.7% (p &lt; 0.5)</td>
</tr>
</tbody>
</table>
A significant number of the study subjects also reported having COPD, although their spirometric tests did not confirm bronchial obstruction. Only in 24.4% of the subjects reporting COPD was bronchial obstruction confirmed by spirometric test. It suggests the insufficient education of the doctors in relation to making diagnoses contrary to the accepted criteria. It is unlikely that so many people do not remember their actual diagnosis, and such a discrepancy in this case clearly justifies the implementation of large-scale informational and educational campaigns, not only for society, but also for the primary healthcare physicians, as is the case with the National Spirometry Days, World Spirometry Days, Asthma Day and COPD Day.

Media reports associated with the Spirometry Days build awareness of the disease in diagnosed patients (asthma, COPD), but more importantly, have an effect on people who have been experiencing respiratory symptoms (cough, dyspnea), yet ignore them.

A key risk factor associated with obstructive diseases, primarily COPD, i.e. tobacco smoking, the second important factor is exposure to air pollution, which contributes to a chronic bronchial inflammation. In cities, apart from the pollution generated by the public utility and housing sector, the main source of air pollution is traffic and therefore living near busy roads is very significant. Similar conclusions are presented by Schikowski et al. [21]. In a study conducted between 1985 and 1994, 4,757 women living in Germany were tested. The main goal was to analyze the effects of exposure to air pollution on respiratory function and COPD incidence. The researchers demonstrated that living closer than 100 meters to a busy street adversely affects respiratory function, and increases the risk of COPD by 1.79 times (95% Cl: 1.06-3.02) in comparison to people living further from a street. The occurrence of similar adverse effects is also confirmed by the analyses presented in this study. In non-smokers and people living up to 50 meters from a busy street (in cities with population of ≥100,000) obstruction was found in up to 28% of all the study subjects in the area, whereas among the people living further away from a street (≥50 meters) the rate was <20%.

Based on studies conducted in years 2013 and 2014, repeatability of the results was obtained, demonstrating that bronchial obstruction can be observed in 18.9-19.7% of random subjects having a spirometric test. In people receiving a spirometric test for the first time the rate is 16.3-17.8%. Therefore, spirometry should be publicly available at an early stage of medical care.

However, the quality of spirometric tests performed remains an important problem. It demonstrates the importance of education for medical personnel, and proper reviews over the quality of test results.

According to the outcomes of the studies presented in this article, the awareness of pulmonary obstructive diseases in Poland is very limited, considering the high percentage of people who believe they have diseases from which they do not actually suffer, as well as the significant rate of people receiving a spirometric test for the first time and being diagnosed with a previously undetected bronchial obstruction. A large number of people who took a spirometric test for the first time during the Spirometry Days (nearly two thirds of the subjects tested) demonstrated the need for such tests, which should become common screening tests.

According to global reports [22], Spirometry Days, together with education regarding the adverse effects of smoking and air pollution, improve the diagnostics of pulmonary obstructive diseases and provide a simple method of changing the current underdiagnosis of COPD. As part of the educational project "Healthy lungs for life", on the World Spirometry Day in 2014 free spirometric tests were performed in over 80 countries, during 760 mass events.

Initiatives such as Polish Spirometry Day or World Spirometry Day increase the social awareness of respiratory diseases, their causes, associated risk factors, courses of a disease and its health effects, while, by providing the person tested with a letter to a primary healthcare physician (in the case of incorrect

### Table 3. Basic spirometric values in the study group from cities (≥100,000 inhabitants), towns (<100,000 inhabitants) and rural areas

<table>
<thead>
<tr>
<th>Spirometry results</th>
<th>Cities</th>
<th>Towns</th>
<th>Rural areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEV₁</td>
<td>91.69 ± 21.26</td>
<td>93.21 ± 21.57</td>
<td>95.57 ± 23.22</td>
</tr>
<tr>
<td>FVC</td>
<td>99.92 ± 22.42</td>
<td>99.48 ± 21.88</td>
<td>101.46 ± 25.76</td>
</tr>
<tr>
<td>FEV₁/FVC</td>
<td>76.359 ± 11.534</td>
<td>77.751 ± 11.115</td>
<td>80.10 ± 9.071</td>
</tr>
</tbody>
</table>

### Table 4. Percentage of non-smoking subjects with bronchial obstruction depending on distance between residence and busy street

<table>
<thead>
<tr>
<th>Distance from busy street</th>
<th>&lt;100 thousand</th>
<th>≥100 thousand</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;50 m</td>
<td>18.56%</td>
<td>28.24%</td>
</tr>
<tr>
<td>≥50 m</td>
<td>14.56%</td>
<td>19.66%</td>
</tr>
<tr>
<td>&lt;100 m</td>
<td>16.80%</td>
<td>25.93%</td>
</tr>
<tr>
<td>≥100 m</td>
<td>15.94%</td>
<td>20.41%</td>
</tr>
</tbody>
</table>
spirometry results), they improve the diagnosis of obstructive pulmonary diseases [23].

**Literature**


2. ECAP Epidemiologia Chorób Alergicznych w Polsce: raport z badań przeprowadzonych w latach 2006-2008 w oparciu o metodologię ECRHS II i ISAAC. [ECAP Epidemiology of Allergic Diseases in Poland: report from studies conducted in years 2006-2008, based on the ECRHS II and ISAAC methodology] www.ecap.pl


Methodology for assessing the fate and oxidative stress effects of inhaled NPs on human volunteers. Two case studies

Metodologia oceny badań stresu oksydacyjnego wdychanych nanocząsteczek u ochotników. Opis dwóch przypadków

Halshka Graczyk¹, Michael Riediker¹, ²

¹ Institute for Work and Health; director: David Vernez, PhD
² SAFENANO, IOM Singapore; director: Michael Riediker, PhD

This article was based on H. Graczyk’s presentation at the General Wojciech Lubiński, PhD Conference “The effects of air pollution on human health” held on 24.04.2015 at the Military Institute of Medicine in Warsaw.

Abstract. Due to their novel physical-chemical properties, nanoparticles (NPs) have gained a prominent position in a variety of industrial and consumer applications. The increased production of medical NPs has sparked interest for new therapeutic applications, specifically for pulmonary drug delivery. As the lungs represent an excellent entry portal for aerosolized NPs due to their high surface area, thin epithelial barriers and extensive vasculature, the ability of NPs to translocate into the systemic circulation may be promising for medical purposes. However, nanomedicine and nanotoxicology currently lack precise information about the actual deposited dose after NP inhalation, their fate in the human body and their ability to induce unwanted biological effects such as oxidative stress. This paper presents a methodology for assessing the fate and oxidative stress effects of inhaled NPs in human volunteers. A controlled human inhalation study was designed and the preliminary phases were implemented, and two case studies are detailed here. The first case study presents preliminary evidence from aerosolized medical nanoparticles, superparamagnetic iron oxide nanoparticles (SPIONs). The second case study focuses on NPs produced in Tungsten Inert Gas (TIG) welding. Preliminary results show that both aerosolized SPIONs and TIG welding NPs may be interesting experimental NPs for application in a human exposure study. As we lack a full understanding of the chain of events between initial deposition of NPs in the lung to their health effects, this methodology, once fully applied, will allow for a non-invasive evaluation of the inhalated NP target dose that is important for the development of therapeutic applications as well as for human health risk analysis.

Key words: nanoparticles, oxidative stress, SPIONs, translocation, welding fumes

Streszczenie. Dzięki swym nowym właściwościom fizykochemicznym nanocząsteczki (NPs) zajmują ważną pozycję w różnych przemysłowych i innych użytkowych zastosowaniach. Wydaje się jednak, że największe znaczenie mają w medycynie, a zwłaszcza w aplikacji leków wizywnych. Płuca stanowią bowiem znakomite wrota dla aerozoli zawierających nanocząstki, gdyż mają dużą powierzchnię wchłaniania, cienką barierę nabłonkową i rozbudowane unaczynienie, co stwarza szczególne możliwości przenoszenia NPs do układu krążenia. Niestety, jeszcze nie dysponujemy danymi na temat tego, w jaki sposób i jakie wielkości wchłanianych cząstek generują stres oksydacyjny, co może powodować niekorzystne zmiany biologiczne w organizmie ludzkim. Głównym założeniem przedstawionych badań jest określenie, w jaki sposób stres oksydacyjny spowodowany wdychaniem nanocząstek działa na żywy organizm ludzki. W manuskrypcie przedstawiono wstępne wyniki badania u ludzi skutków wdychania nanocząstek. Pierwsza część dotyczy badań zdrowotnych skutków wdychania supermagnetycznych tlenków żelaza (SPIONs), które były odpowiednio aerozolizowane do celów tego badania. Druga część badań dotyczy specyficznych nanocząsteczek spawalniczych (TIG). Wstępne wyniki eksperymentów dotyczących SPIONs i NPs w oparach spawalniczych mogą mieć znaczenie dla rozumienia innych procesów dystrubycji NPs w płucach i generacji stresu oksydacyjnego. Ta metodologia umożliwi ocenienie w nieinwazyjny sposób translokacji wdychanych NPs i stresu oksydacyjnego oraz znalezienie sposobów aplikacji terapeutycznej i ocenę ryzyka dla zdrowia człowieka.

Słowa kluczowe: nanocząsteczki, translokacja, stres oksydacyjny, SPIONs, opary spawalnicze

Delivered: 19/10/2015.
Accepted for print: 1/12/2015
No conflicts of interest were declared.
Corresponding author
Michael Riediker, PhD
SAFENANO, IOM Singapore
30 Raffles Place, #17–06 Chevron House, Singapore, 048 622
telephone: +65 6809 6249
e-mail: michael.riediker@iom-world.sg (in English)
e-mail: halshka.graczyk@chuv.ch (in Polish)
Introduction
Nanoparticles (NPs) are defined as primary particles with at least one dimension of less than 100 nm. Nanosize is a major defining characteristic of NPs, leading to unique physicochemical properties that distinguish their behavior from their bulk material counterparts. The unique properties of NPs may result in highly desirable behavior, including but not limited to increased reactivity, higher conductivity, or better penetration. As such, the last decade has witnessed the exploitation of these unique properties for industrial applications, and various types of engineered NPs have found their way into many sectors, including aerospace, cosmetics, foods, electronics and medicine.

Human exposure: inhalation
The lungs are an efficient entry portal for gaseous components and aerosol-transported molecules as they present a high surface area with a thin epithelial barrier in addition to extensive vasculature, allowing high systemic absorption rates [1]. Due to these factors, NPs are being studied for the pulmonary administration of medicinal agents. NPs as a drug delivery vehicle via the lung are also advantageous due to their longer retention time (due to decreased clearance), allowing for the prolonged release of the drug load [2].

The same properties that are beneficial for drug delivery, however, may pose a health risk if the lungs form an entry portal for non-medical NPs. One risk is that the NPs will transfer to the blood and translocate to the secondary organs. Once deposited in the lungs, NPs generally tend to be slowly removed by macrophages and mucociliary clearance, increasing their interaction with lung cells and possible relocation [3]. Their most important clearance pathway of NPs from the air ways is via macrophages toward the larynx. Even particles that were relocated into deeper parts of the lung epithelia seem to reappear again on the lung surface and be cleared by macrophages [4]. The translocation to the blood is generally low, as demonstrated for nanosized 192Ir-iridium [4], or TiO2 in rats [3]. For human studies, such translocation is estimated to be less than 1% of the mass-based dose delivered to the lungs [5]. Furthermore, inhalation studies have shown that the olfactory bulb provides a connection between the nose and the brain, allowing inhaled NPs to enter this organ [6].

In regards to adverse health effects, three main cellular responses to NP exposure have been presented, including the production of reactive oxygen species (ROS), injury to DNA, and release of proinflammatory compounds. There is a consensus that the induction of ROS by NPs is a key event in the toxicological cellular response [7].

Conducting human inhalation studies with NPs
While humans have long been exposed to unintentionally produced NPs, the recent increase in engineered NP production, particularly for medical applications, demands more research on any potential adverse health effects after inhalation. Both nanotoxicology and nanomedicine currently lack precise information about the actual deposited dose after NP inhalation, their fate in the human body and their ability to induce unwanted biological effects such as the generation of oxidative stress. Although data from in vitro and animal in vivo NP inhalation studies are available, these results are not easily extrapolated to judge the effects in humans. Currently, very few controlled human exposure studies exist that assess the fate and health effects of inhaled NPs, due mainly to safety and ethical concerns. These restrictions are clearly necessary to protect the health and safety of the subjects; yet, if science is to answer important questions related to the health effects of inhaled NPs, ethical solutions for controlled human inhalation studies must be developed. Alas, the questions remain: what are the potential methodologies for relevant, and ethical, human inhalation studies to assess the fate and health effects of inhaled NPs; and what are potential NPs that can be applied in such studies?

Case Study 1: Superparamagnetic iron oxide nanoparticles
Certain engineered NPs developed under Good Manufacturing Practice (GMP) conditions and approved for market use may form interesting candidates for human inhalation studies. In the last decade, medical NPs that have been of particular interest are SPIONs due to the number of useful properties, such as biocompatibility, biodegradability and superparamagnetism. SPIONs offer a promising application for the targeted imaging and treatment of lung cancer [8, 9]. SPIONs can be chemically modified or engineered for simultaneous biomedical functions, their application as aerosolized therapeutics may be used to increase drug dosage to the lungs while reducing systemic side effects [10]. Numerous preclinical and clinical studies have been conducted using SPIONs, resulting in their clinical approval for intravenous and oral administration [11, 12]. However, SPIONs have not yet been administered as pulmonary therapeutic agents.
for the treatment and prevention of lung disease. Nevertheless, it has been suggested that SPIONs may be strong candidates for controlled human inhalation studies as well as for application as aerosol-mediated nano-therapeutics. However, no controlled human inhalation studies have yet been conducted with SPIONs as the aerosolized test substance.

**Case Study 2: Tungsten Inert Gas Welding Fume NPs**

Certain workplace environments may provide unique inhaled exposures to NPs. Welding may be of particular interest to nanotoxicology research due to the generation of high particle concentrations that may occur at the nanoscale level, and the large number of operators who may be exposed [13]. Metal oxide NPs in welding fumes have gained increased attention due to their potential for triggering oxidative stress reactions and their contribution to adverse respiratory and cardiovascular outcomes [14].

When compared to various welding processes, TIG, also known as Gas Tungsten Arc Welding, has been reported as generating the majority of its particles on the nanoscale level [15]. As such, TIG welding fume NPs are of particular interest due to their potential toxicological properties related to their small size. TIG welding has become one of the most popular welding methods in various industrial sectors [16]. Despite the increase in TIG welding use and its ability to generate NPs, there is limited data available for its characterization, as well as for potential health effects after inhalation.

**Methods**

A controlled, human inhalation study has been designed, in which healthy non-smoking volunteers are exposed to aerosolized NPs for 60 minutes. Exhaled breath condensate, blood and urine is collected before exposure, immediately after exposure, 1 hr and 3 hrs post-exposure (figure 1). Volunteers participate in a control day to account for oxidative stress fluctuations due to circadian rhythm. All three biological liquids are assessed for total reducing capacity, hydrogen peroxide, malondialdehyde, and 8-hydroxy-2′-deoxyguanosine concentrations at each time point. A self-reported health questionnaire is given before and after exposure to assess self-reported symptoms. As we still lack a full understanding of the chain of events linking the initial deposition of NPs in the lungs to their health effects, this methodology allows the non-invasive evaluation of the inhaled NP target dose, which is important for the development of medical applications as well as for human health risk analysis.

**Case studies**

The case studies presented below describe the first steps necessary for conducting human inhalation studies.

**Case Study 1: Aerosolized SPIONs for application in human inhalation studies**

The first step in aerosolizing SPIONs for human inhalation studies was the development of a custom nebulization system. The custom nebulization consisted of a single-jet Collison nebulizer (BGI Incorporated, Waltham, MA, USA), glass mixing tube (length: 53.5 cm and diameter: 8.3 cm), and collection and measurement station. In this system (figure 2), the Collison nebulizer was fed by a 50-L cylinder of respirable air. A second airflow of dry filtered air led to the glass mixing tube in order to homogenize the two airflows and establish a stable humidity level. The nebulizer was operated at 20 pounds per square inch (psi) with a flow rate of 2 L/min from the air cylinder. The nebulizer generated an aerosol by aspirating the suspension through a sonic-velocity jet, thus shearing the liquid into droplets. The second airflow to the mixing tube was set at a complementary rate of 2 L/min in order to obtain an average humidity of 50% throughout the exposure system. The mixing tube was then connected directly to a scanning mobility particle sizer [SMPS; Grimm, Airning, Germany; models 55–40-25 (CPC) and 5.403 (DMA)] for the characterization of particle size distribution/number concentration of the aerosol. Conductive tubing (Milian SA, Geneva, Switzerland) with an internal diameter of 8 mm was used with the shortest lengths possible to enhance particle transport and reduce particle loss to the tubing. A full description of nebulization system can be found in Graczyk et al. [17].

A SPION-based medicine (tradename: Rienso) was purchased commercially from the University Hospital of Lausanne Pharmacy (Lausanne, Switzerland). Four concentrations of Rienso suspensions were prepared for nebulization by diluting 167 μL, 333 μL, 667 μL, and 1,333 μL of Rienso with 100 mL of GenPure water at room temperature to achieve suspension mass concentrations of 0.05 mg/mL, 0.1 mg/mL, 0.2 mg/mL, and 0.4 mg/mL, respectively. Rienso solutions were nebulized immediately after preparation within the nebulization system described above.
Full results of the nebulization study are summarized in Graczyk et al. [17]. In brief, we found that when the Rienso solution was nebulized at each of the four concentrations, a peak concentration at a stable and reproducible particle size of approximately 75 nm was measured by the SMPS. Transmission Electron Microscopy (TEM) analysis of the aerosolized Rienso suspension demonstrated a clustering of primary particles into agglomerates with a mean diameter of approximately 75 nm, thus matching the SMPS results.

**Case Study 2: Characterization of TIG welding fume NPs for human inhalation studies**

To assess the feasibility of conducting a human inhalation study with occupational NPs, specifically TIG welding fume NPs, we conducted an exposure assessment of TIG welding fumes generated by human volunteers. We recruited apprentice welders from Western Switzerland who met the inclusion criteria (male, non-smokers, between 16 and 25 years old, no respiratory or cardiovascular disease) who had not been chronically exposed to welding fumes in the past. The study was approved by the Ethics Committee of Canton de Vaud, Lausanne, Switzerland, and was conducted in accordance with the Helsinki Declaration.

The volunteers were asked to conduct a 60-minute TIG welding task in a controlled, well-ventilated exposure cabin. The exposure cabin was 10 m² and had a controlled pulsing ventilation system, an exchange rate of 9.3 h⁻¹ and a high efficiency particulate absorption (HEPA) filter for the incoming and outgoing air. In this way, we could assure that volunteers were not exposed to any other type of aerosol during the experiment.
Exposure assessment was conducted for each apprentice welder (N=20) at the breathing zone (BZ) inside the welding helmet. Results of the exposure assessment have been previously summarized in Graczyk et al. [15]. Briefly, we found that particle size distribution at the BZ across all volunteers showed that a majority (92%) of the particles had measured geometric mean diameters (GMDs) below 100 nm, and 50% of the particles had measured GMDs below 41 nm. TEM images analyzed from grids collected for 30 seconds at 0.05 L/min show smaller agglomerates in size ranges below 100 nm.

Discussion

Case Study 1: SPIONs

Results of the SPION (Rienso) characterization revealed a reproducible aerodynamic particle diameter of 75 nm that remained stable over time. We also found that aerosol particle concentration increased linearly with increasing suspension concentration, and these concentrations were reproducible across experiments. These results provide important data towards the application of this suspension in future human inhalation studies. First of all, the stability of aerodynamic diameter over extended aerosolization periods ensures the maintenance of a nanoscaled airborne particle. We showed that particle agglomeration in this study was limited, and remained below 100 nm, providing evidence that aerosolized Rienso may effectively deposit in the alveolar region of the lung. Such deposition reduces the potential of mucociliary clearance towards the larynx and increases the potential for NP interaction with alveolar cells and biological molecules [4]. If we consider that inhaled NPs in this size range face greater NP retention in the small airways of human lungs [18, 19], and that greater retention may increase the probability for particle relocation beyond the epithelial barrier [5], then it may be plausible that inhaled Rienso particles may undergo numerous transport pathways after inhalation. Our findings confirmed the applicability of aerosolized Rienso within the human inhalation study. As such, the human exposure system was completed and validated and remains available for future inhalation studies.
GENERAL WOJCIECH LUBIŃSKI 5TH SCIENTIFIC CONFERENCE

Methodology for assessing the fate and oxidative stress effects of inhaled NPs on human volunteers. Two case studies

Case Study 2: Welding Fume NPs

Results from the TIG welding fume exposure assessment showed that volunteers were exposed to high-number concentrations of aerosolized particles almost exclusively below 100 nm. Previous studies of TIG welding fume NPs have confirmed that the agglomerate emission rate for TIG welding is relatively low [20]. Brand et al. [13] showed that the agglomeration of primary particles in TIG welding is much slower than

---

**Figure 3.** High-resolution TEM micrograph of aerosolized Rienso collected on a TEM grid. A. Scale bar = 2 μm. B. Scale bar = 200 nm. First published in Graczyk et al., 2014 (ref 17). Open Use Access by Mary Ann Liebert, Inc., Copyright Clearance Center.

**Rycina 3.** Duża rozdzielczość mikrografii TEM aerozolu Rienso zgromadzonego na kracie TEM. A. Skala = 2 μm. B. Skala = 200 nm. Opublikowane po raz pierwszy w Graczyk et al., 2014 (ref 17). Otwarty dostęp wykorzystanie przez Mary Ann Liebert, Inc., Copyright Clearance Center.

**Figure 4.** High resolution TEM micrographs of collected TIG particles at 0.05 L/min for 30 seconds. Letters indicate examples of mean diameters (average of 3 replicate measurements) with ImageJ software (NIH, USA). A (left). A = 40 nm; B = 45 nm; C = 20 nm. B (right). A = 43 nm, B = 29 nm, c = 5 5 nm. Scale bar = 200 nm. First published as supplementary data in Graczyk et al., 2015 (ref 15). Open Access distributed under the Oxford Journals, terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/3.0/)

**Rycina 4.** Duża rozdzielczość mikrografii TEM oparów spawalniczych TIG zgromadzonego na kracie TEM przez 30 sekund, 0,05 l/min. Litery pokazują przykłady uśrednionej średnicy (średnia 3 replikatów) mierzone przez oprogramowanie ImageJ (NIH, USA). A (po lewej). A = 40 nm, B = 45 nm, c = 20 nm. B (po prawej). A = 43 nm, B = 29 nm, c = 55 nm. Skala = 200 nm. Opublikowane po raz pierwszy w Graczyk et al., 2015 (ref 15). Otwarty dostęp wykorzystanie przez Oxford Journals, Creative Commons Attribution License (http://creativecommons.org/licenses/by/3.0/)
in other welding processes due to different coagulation dynamics after primary particle formation related to the low mass emission rates of TIG welding (0.01–0.05 mg·s⁻¹). Given the evidence that nanoscaled particles produced in TIG welding may be stable for some time in the air confirms our hypothesis that TIG welding presents a significant hazard for inhaled NP exposure. Such workplace exposures may provide an interesting setting for human health risk assessment of the fate of inhaled particles, as well as their oxidative stress effects. Complete results of the oxidative stress effects in human volunteers exposed to TIG welding fume are forthcoming.

Conclusions
We developed a methodology to assess the fate and oxidative stress effects of inhaled particles in human volunteers. We implemented the first phase of the study with aerosolized SPIONs and with TIG welding fume NPs. Results from the first phase of these studies show that both types of NPs may be interesting to apply within human inhalation studies in the future. Oxidative stress results from the studies are forthcoming. As both nanomedicine and nanotoxicology lacks precise data on the fate and oxidative stress effects of inhaled NPs, these results, once published, will provide critical information for both pulmonary therapeutics, and for human health risk assessment.

Acknowledgements
The authors would like to thank the Swiss National Science Foundation, NRP 64 Project, Grant No. 406440J31 282 for funding the doctoral research of H.G. The authors would also like to thank the 1ST collaborators that assisted with the two case studies: Nastassja Lewiński, Jiayuan Zhao, Jean-Jacques Sauvain, Guillaume Suarez, Pascal Wild, and Nicolas Concha-Lozano.

Literature
6. Oberdörster E. Manufactured nanomaterials (fullerenes, C60) induce oxidative stress in brain of juvenile largemouth bass. Environ Health Perspect, 2004; 112: 1058-1062
Knowledge levels concerning the radiological protection of patients and medical staff. An assessment of nursing department students of the Medical University of Warsaw

Ocena poziomu wiedzy studentów kierunku Pielęgniarstwo Warszawskiego Uniwersytetu Medycznego na temat ochrony radiologicznej pacjenta i personelu medycznego

Dominik Olejniczak¹, Justyna Bastecka², Urszula Religioni³, Wojciech Boratyński¹, Robert Słoniewski¹

¹ Medical University of Warsaw, Institute of Public Health; head: Assoc. Prof. Adam Fronczak MD, PhD
² Oncological Endocrinology and Nuclear Medicine Teaching Hospital, Iodine Therapy Department, Oncology Centre – Maria Skłodowska-Curie Institute in Warsaw; head: Assoc. Prof. Marek Dedecjus MD, PhD
³ Collegium of Socio-Economics, Warsaw School of Economics; dean: Assoc. Prof. Jacek Osiński

Abstract. Artificial ionizing radiation is used for medical purposes both in diagnostics and treatment. Diagnostic imaging is the basis of most diagnostic procedures, which translates into treatment results. Radiology is a very special branch of medicine. Radiation in high doses can cause damage to the health and, in extreme cases, even death. Therefore, it is very important to have some understanding of radiation protection and radiation dose limits, in particular among the medical staff. The aim of this study was to investigate the knowledge of students of the Medical University of Warsaw on the radiological protection of patients and medical staff. A survey was used as a study method and the study group involved 103 people. The results showed that the nursing students are prepared to work with ionizing radiation, including radioactive isotopes, indicating that the department curriculum is well designed.

Key words: students, radiation, diagnostic imaging, radioactive isotopes

Streszczenie. Promieniowanie jonizujące wytwarzane sztucznie wykorzystywane jest w medycynie zarówno w diagnostyce, jak i w leczeniu. Diagnostyka obrazowa stanowi podstawę większości procedur diagnostycznych, co przekłada się na efekty leczenia. Radiologia jest bardzo szczególną dziedziną medycyny. Promieniowanie w dużych dawkach może spowodować uszkodzenie zdrowia, a w skrajnych przypadkach nawet śmierć. Dlatego bardzo ważnym elementem jest znajomość ochrony radiologicznej i norm dopuszczalnego napromienienia, zwłaszcza wśród personelu medycznego. Celem niniejszego badania było poznanie wiedzy studentów Warszawskiego Uniwersytetu Medycznego na temat ochrony radiologicznej pacjenta i personelu medycznego. Techniką użyta w badaniu było ankietowanie, a grupę badaną stanowiły 103 osoby. Wyniki badania pokazały, iż studenci kierunku Pielęgniarstwo są przygotowani do pracy z promieniowaniem jonizującym, w tym z izotopami promieniotwórczymi, co wskazuje na właściwie ułożony program nauczania na tym kierunku.

Słowa kluczowe: studenci, promieniowanie, diagnostyka obrazowa, izotopy promieniotwórcze

Delivered: 09/10/2015
Accepted for print: 01/12/2015
No conflicts of interest were declared.

Corresponding author
Dominik Olejniczak MD, PhD
Institute of Public Health
Medical University of Warsaw
1a Banacha St., Building F, 02-097 Warsaw
telephone: +48 22 599 21 80
e-mail: dominikolejniczak@op.pl

Copyright by the Military Institute of Medicine

Knowledge levels concerning the radiological protection of patients and medical staff. An assessment of nursing department students of the Medical University of Warsaw
**Introduction**

Radiology is a rapidly developing field of medicine, essential for oncological diagnostics and therapy. Along with progress in science, an awareness of the risks associated with ionizing radiation and electromagnetic fields should also increase in society. High doses of radiation may adversely affect the health, and even lead to death. The effects of radiation may be observed both shortly after the exposure and many years later. Changes and damage caused by radiation are found at all organizational levels of living matter: from molecule, cell, tissue, organ and organism, up to the population level. The consequences of excessive exposure of a living organism to ionizing radiation includes neoplastic lesions, genetic mutations and fetal damage. Radiation used according to the ALARA (as low as reasonably achievable) rule in justified cases is beneficial, and often saves lives. Therefore, an understanding of radiation protection is very important, especially among medical personnel.

In the course of medical studies certain issues regarding radiation protection are taught as obligatory topics. However, it is worth checking to see if they are sufficient to ensure that future healthcare professionals are aware of their responsibility for their patients’ lives, as well as their own. This is also in compliance with the principles of the World Health Organization’s program: Health Promoting Hospital [1-4].

**Aim of the study**

The aim of this study was to determine how much The Medical University of Warsaw students know about radiation protection for the patient and for medical personnel.

**Material and methods**

The statistical analysis involved the verification of the statistical hypotheses based on Pearson’s Chi² test and Spearman’s rank correlation coefficient. Statistical significance of differences in all the tests was achieved when the probability was $p < 0.05$ [5, 6].

The study group consisted of 103 students of the Medical University of Warsaw, Department of Health Sciences, including 97 females (94.18%) and 6 males (5.83%) from the 1st and 2nd year of full-time and part-time MA studies.

A total of 79.61% of the respondents lived in a town or city, and 20.39% in the country. The largest group were respondents aged 22-30 years old (66.02%). The greatest number of respondents, 42.74%, had been working in the profession for 2-5 years (Fig. 1.). The next largest group were people working in the profession for over 10 years (32.04%). Under 1% of respondents had been working for less than a year.

Surgeries (22.33% of the respondents), outpatient clinic/health centers (12.62% of the respondents) and operating theatres (5.83% of the respondents) were the most common places of work for the study subjects. Nearly 21% of the study group had yet to start professional work.

**Results**

Before answering the target questions, the students were asked how they evaluated their knowledge of radiation protection. Nearly 3% of the respondents declared their level of knowledge as very high, and 2% as very low. Most study subjects, 57.28%, declared their level of knowledge as average. A total of 13.59% of the respondents perceived their level of knowledge as low, and 24.27% as high. At the end of the questionnaire the respondents were asked again to declare the level of their knowledge. Less than 1% of the respondents perceived it as very high, and 8.74% declared it was high. The largest group, 49.52%, classified their knowledge of radiation protection as average. As many as 25.24% of the respondents decided their level of knowledge was low, and 10.68% declared it as very low (Fig. 2.).

Comparing the answers to both questions one may observe that the questions in the survey lowered the self-evaluation of the respondents.
The number of respondents assessing their level of knowledge as very high, high and average decreased, and the number of people declaring their level of knowledge as low or very low increased, while almost 5% of the respondents chose not to answer the second question. However, in neither case was a correlation between the respondents’ years of work and evaluation of their knowledge on radiation protection observed ($p > 0.005$).

The question "What is radiation?" was correctly answered ("energy emission and radiation") by 32.03% of the respondents, while much more often an incorrect answer was provided: "emission and radiation of an electromagnetic charge" (60.19% of the respondents). However, no difference was found in the relationship between the correct answer and years of work ($p > 0.05$).

Less than 11% of the respondents correctly answered the question "What is ionizing radiation?" ("Corpuscular and electromagnetic radiation"). The most common incorrect answer was: "X-radiation" (30% of the respondents). Any differences in responses were related to the period of work of the respondents ($p = 0.000; R = 0.007$), with 14.29% of the respondents working for less than a year providing the correct answer; in the group of people working for over 10 years the rate was 3.03%.

In the open question: "What is a radioactive isotope?", the model answer stipulated that it is a radioactive isotope/radionuclide in which all atomic nuclei undergo radioactive decay. The answer complying with this requirement was provided by 30.10% of the respondents.

Another open question was “What is the name of the branch of medicine using radioactive isotopes in therapy?”. Over 31% of the respondents provided the correct answer, and almost half (49.51%) gave incorrect answers.

The majority of the respondents, 79.61%, responded correctly (“yes”) to the question "Can a radiological procedure be performed in a woman of childbearing potential who has not been found pregnant without confirming pregnancy or its absence?" Correct answers were provided more frequently by younger employees ($p = 0.001; R = 0.070$).

The question "Does an occupational physician issuing certificates to employees working with ionizing radiation have to have special authorization?" was correctly answered ("yes") by 56.31% of the respondents, mostly by people working for 2-5 years (76% of the respondents) ($p = 0.001; R = 0.143$).

In a multiple-choice question the majority of respondents provided correct answers, declaring that the person holding a patient needs to be instructed about the procedure and radiation risk (71.84%), as well as being equipped with a protective lead apron and gloves (88.35%). Importantly, the person cannot be pregnant (80.53%), but does not need to hold a dosimeter (73.78%), and should be at least 18, not 16 years old (92.23%).
In the question about the remote somatic effects of radiation the correct answers included: opacification of eye lens / cataract (35.92% of correct responses), malignant neoplasms (76.69% of correct responses), infertility (66.01% of correct responses), impaired growth and development (44.66% of correct responses), and chromosomal aberrations in somatic cells (27.18% of correct responses).

Only 33.98% of the respondents correctly answered the question “Does any radiation penetrate to the computed tomography control room?” (The correct answer being: “yes, radiation penetrates”). The structure of the responses varied between groups. Usually younger employees provided more correct answers (32.65% in the group of people working for less than a year, 48% in the group of people working for 2-5 years, and 0% in the group of people working for 6-10 years and 18.18% in the group of people working for over 10 years) (p = 0.000; R = 0.664). The question “Does computed tomography use roentgen radiation, i.e. X-ray radiation?” was correctly answered by 80.58% of the respondents. Differences between the groups of respondents with different years of work experience were not statistically significant (p > 0.05). Nearly 43% of the respondents believed that an irradiated person emits radiation, which is incorrect. The correct answer was provided by 33.98% of the study subjects, mostly those who had worked the longest (p = 0.045; R = 0.040).

According to the respondents, the following have access to the controlled area: employees authorized to work with radiation and patients being evaluated; this correct answer was chosen by 33.98% of the survey subjects. Correct answers were provided by nearly 40% of respondents in the groups of those working for less than a year and for over 10 years, 24% of people working for 2-5 years, half of those working for 6-10 years and 23.81% of people without any work experience (p = 0.000; R = 0.155).

The number of correct answers to the question about the most important factors protecting from radiation was very high. The most frequently chosen correct answers included: “time” (70.87% of the respondents), “distance” (97.08% of the respondents) and “shields” (98.05% of the respondents).

Bone marrow was most incorrectly believed to be the organ most sensitive to radiation (39.80% of correct responses); the gonads are more sensitive, and 38.83% of the subjects provided this answer. The correct response was more often given by older employees (approx. 50% of those working for 6-10 years and over 10 years, compared to 35-40% of the correct responses in other groups) (p = 0.027; R = 0.073).

The most common post-radiation neoplasm is leukemia. This answer was offered by 33.01% of the respondents. In this case, however, no statistically significant differences were found between the correct answers provided by different groups (p > 0.05).

Discussion

Publications regarding how much students know about the radiation protection of patients and medical personnel are difficult to find. In the available scientific literature no studies were found demonstrating the level of knowledge presented by university students.

In 2014, the Philips Company conducted a study about Polish people’s opinion about radiation. Only 13% of Poles associated the use of X-rays with the diagnostics of cardiac diseases, and one in three respondents associated it with the diagnostics of neoplasms. 75% of respondents believed that X-ray images are used to evaluate damage to the bone system, 58% related it to dental procedures. Over half (58.2%) of the students of the Medical University of Warsaw knew about the tests performed with the use of an X-ray tube, and approximately 34% could list them [7].

In 2014, the British Institute of Radiology published an article on the awareness of radiation protection in non-radiologists. The study comprised 120 physicians, and 37% of the respondents had not participated in a course on radiation protection, and none of them could calculate a radiation dose. The majority were not aware of differences in organ sensitivity to ionizing radiation. To compare the results, our own study revealed that most students knew that the organ most sensitive to radiation is bone marrow (39.8%), and next are gonads (38.8%) [8].

In 2014, in medical universities in Saudi Arabia and Sudan, studies were conducted involving groups of medicine students, trainees and residents, the study comprising 210 respondents. All of them received formal training in radiation protection, and 8% specialized in radiation hazards. A total of 98.4% demonstrated a low level of knowledge in all the aspects under study. A high level of knowledge on radiation protection was achieved by 24.2% of the respondents, and by 9% in practical aspects associated with the use of radiation, whereas 1% of the respondents presented a high level of basic knowledge of radiation protection. Our own studies demonstrate that 60% of the respondents provided correct answers, presenting an average level of knowledge about radiation protection. The calculations were based on statistical analysis, and confirmed the zero hypothesis [9].

In 2007, A. Arslanoglu et al. conducted a study among 117 physicians and trainee doctors to determine their knowledge about the exposure of patients to doses...
of ionizing radiation during radiological diagnostic tests. They were mostly internists, and revealed that 93.1% could not determine a radiation dose. A total of 4% of the study subjects did not know that ultrasound tests use ionizing radiation, and 27.4% of the respondents were not aware that magnetic resonance employs an electromagnetic field, and not ionizing radiation. A comparison of this data with our own study demonstrates that 80.6% of the students of the Medical University of Warsaw are aware that ionizing radiation is used in computed tomography [10].

The high level of knowledge presented by the respondents is of particular importance in the light of the studies by Szmigielski and Sobiczewska on the risk of neoplastic diseases from exposure to power fields [11].

Conclusions
1. The curriculum of 1st degree nursing studies is sufficient to familiarize students with the problem of radiation protection.
2. In the course of studies issues related to therapy and diagnostics using radioactive isotopes should be discussed.
3. Students are prepared to work with radiation, their knowledge and understanding of the atomic energy law suffice to ensure safety during work with radiation.
4. The education of nurses in Poland represents a higher level than that of physicians and students of medicine from Great Britain, Saudi Arabia, Sudan and Turkey. In these countries the material taught in radiology courses should be verified.

Literature
6. Łobocki M. Wprowadzenie do metodologii badań pedagogicznych. [Introduction to methodology of pedagogical studies] Oficyna Wydawnicza Impuls, Kraków 2006
Changes in the self-assessment of quality of life as a result of hematological disease

Zmiany w ocenie jakości własnego życia spowodowane chorobą hematologiczną

Wiesław Skrzyński
Department of Internal Diseases and Haematology, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine in Warsaw; head: Prof. Piotr Rzepecki MD, PhD

Abstract. On confirmation of the diagnosis of a life-threatening disease, most patients experience extremely difficult moments, often referred to as diagnosis shock. At the same time they seek effective ways to cope with the situation; they try to save and rediscover value in their lives despite the diagnosis of leukemia or myeloma. Therefore, how is the quality of life in such a situation rated by 41 hematological patients, regarding general life satisfaction, and to what extent do they change their satisfaction rating in different areas of life? The paper seeks answers to such questions based on a study undertaken in the years 2012–2015 in the Department of Internal Diseases and hematology of the Military Medical Institute in Warsaw.

Key words: quality of life, leukemia, satisfaction from different areas of life before and during the disease

Introduction

Medicine is facing a new task, that of improving the quality of increasingly long human life. While evaluating the quality of life from the point of view of the patients, the importance of the mental state is greater than that of the physical condition, whereas during the assessment of health condition the opposite is the case [1]. People need more than a simple removal of their shortcomings; they wish to be satisfied with themselves, as well as with their lives [2].

People are able to assess only their own lives, which they do according to individually chosen criteria, using selected parameters and assessment methods. Quality of life is difficult to measure, so the tools employed to achieve this goal should enable patients to express their personal, internal feelings. Questionnaires are used as such tools to assess various aspects of life. Partial results, which are conventional values attributed to partial individual aspects, are summed up as a total score. This enables the determination of the effects of a serious hematological disease on the assessment of the patients’ quality of life, and to understand the experience.
of shock at the diagnosis associated with the health hazard situation and, still too often, the risk to the patient’s life.

Assessment of one’s life and its individual aspects can become a stimulus to seek more effective therapies, depending on the patient’s individual life situation, personality, mental condition, personal expectations and previous life experience [3].

Research questions
1. How high is general life satisfaction in chronically ill patients diagnosed with leukemia?
2. What is the level of satisfaction with individual aspects of life in patients with hematological diseases?
3. Does the change in subjective assessment of the quality of life result from the developing leukemia? How strong is the change?

Material and methods
The study involved 41 patients at the Department of Internal Diseases and Hematology, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine in Warsaw. All the patients were diagnosed with a form of leukemia. The connotation of the term “leukemia” is not differentiated by patients, so the study subjects were not divided according to the subtype of the disease. Such a connotation is usually associated with the shock resulting from the diagnosis, as well as with a similar therapy experience. The study group consisted of adult patients of varied socio-professional status, aged 18-52 years. Their problems after the diagnosis of leukemia became very similar, and the relationships between them resulted in unusual equity, or even intimacy. The patients were treated in the years 2012-2015, and most of them (11 of the study subjects are deceased) are still under the care of the Military Institute of Medicine hematological department or clinic. Two research tools were used in the study:
- SWLS scale, to measure general life satisfaction,
- Satisfaction Questionnaire, to assess satisfaction with the individual areas of one’s life.

The most common method used to measure satisfaction with life is the Satisfaction With Life Scale, consisting of five statements. Its authors are Diener, Emmons, Larson and Griffin [4], adapted by Juczyński [5]. Patients assess each statement in reference to their lives on a scale of one to seven. The ultimate result indicates the level of life satisfaction, and ranges from 5 to 35 points. The higher the score, the greater the life satisfaction it expresses. The scale is intended for adults, both ill and healthy.

### Table 1. Average results in hematological patients (SWLS scale)

<table>
<thead>
<tr>
<th>Statements in the SWLS scale</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>In most ways my life is close to my ideal</td>
<td>3.87</td>
</tr>
<tr>
<td>2</td>
<td>The conditions of my life are excellent</td>
<td>4.41</td>
</tr>
<tr>
<td>3</td>
<td>I am satisfied with my life</td>
<td>5.32</td>
</tr>
<tr>
<td>4</td>
<td>So far I have got the important things I want in life</td>
<td>4.01</td>
</tr>
<tr>
<td>5</td>
<td>If I could live my life over, I would change almost nothing</td>
<td>4.39</td>
</tr>
</tbody>
</table>

The Satisfaction Questionnaire in its original version was developed by Fahrenberg et al. at the University of Freiburg [6]. Prior to its publication numerous verification and standardization studies were conducted [7]. The questionnaire is based on the assumption that partial satisfaction regarding individual aspects of one’s existence mediates and directly affects the general satisfaction with life [8].

In the Polish version, developed by a team of scientists as part of a grant from the Ministry of Science and Higher Education in the years 2008-2010 [9], the Satisfaction Questionnaire allows one to express satisfaction with life in 14 important categories: financial situation, health, work, marriage/relationship, one’s children, sexual activity, interpersonal relations, resourcefulness, life achievements, decisions, appearance, tasks and accommodation.

All the categories are evaluated in five dimensions:
- current satisfaction,
- previous evaluation of a given category,
- satisfaction expected in the future,
- comparison of the assessed satisfaction with the level of satisfaction of people around,
- evaluation of my satisfaction in the people around me (projection).

In the presented study assessments were made in only two dimensions: the present (at the diagnosis and during treatment of a chronic hematological disease), and assessments of the past (before the disease). A questionnaire can be used in its entirety or, depending on the purpose of the study, individual categories can be evaluated. It is designed for testing adults. For patients who are single or childless, the irrelevant categories are omitted. Both in the interpretation of individual results and in group studies, assessments of satisfaction in individual categories are compared. One’s satisfaction is evaluated according to a scale from 1 to 5: from complete agreement to negation.
To analyze the results, STATISTICA software was used, available on the Military Institute of Medicine website. The software was used to calculate the significance of differences between both assessments of the patients in the study (Student's t test).

**Results and discussion**

The results of the study are presented in the tables and figures, and demonstrate in a clear and synthetic manner the evaluations obtained from the patients and various correlations.

The assessments of different statements of the Satisfaction With Life Scale are presented in Figure 1. Moderate acceptance of one's existence was expressed in the statement declaring satisfaction with life (M = 5.32, SD = 1.47). Other scores indicate lower assessment of satisfaction with life, and one of them even states that my life is far from my expectations in its ideal version.

In studies on the quality of life satisfaction with individual areas of the patients' lives is rarely assessed, especially in the dimension of present assessment and retrospective evaluation of one's situation before the disease. A list of such assessments is presented in Table 2.

Satisfaction scores in individual areas of one's life were reduced in 10 out of 14 assessed aspects. In 6 cases the reduction was very significant (confidence interval over 0.005), and in 3 cases it was also significant (confidence interval more significant than 0.04).

The greatest change in assessments clearly concerned the health condition: previously, health was assessed as satisfactory (M = 3.59, SD = 1.40), whereas for the present it was assessed as definitely unsatisfactory (M = 2.06, SD = 1.32). The only area with worse ratings was sexual activity (M = 1.71, SD = 1.62). However, in this case the reduced score was in relation to a low level of satisfaction with sexual activity also before the disease (M = 2.65, SD = 1.94).

In other areas of life, such as resourcefulness, dealing with everyday tasks, unfavorable changes in appearance and financial situation, the diseases and its consequences resulted in significantly lower scores. In all cases the ratings were below the low satisfaction level.

Very important and worrying was the level of satisfaction with oneself, already low before the disease (M = 3.94, SD = 1.01), and decreasing due to the further consequences of the treatment (M = 3.59, SD = 0.92). Certainly this change was caused by the symptoms of the disease (hemorrhagic diathesis, general weakness, increased fatigue), as well as the side effects of treatment, especially chemotherapy (nausea and vomiting, hair loss, pancytopenia, infections, loss of appetite, reduced body weight, and lowered mood).

The obtained results are presented in charts. The first gives the mean ratings of individual areas of life after the diagnosis of a chronic disease (Fig. 2.).

For easier interpretation, here is the list of the assessed areas of life:
1 – My financial situation
2 – My health
3 – My work
4 – My relationship/marriage
5 – My children
6 – My satisfaction with myself
7 – My sexual activity
8 – My relations with others

![Figure 1. Average results for hematologic patients for individual items on the SWLS Scale.](image-url)

Rycina 1. Wyniki średnie pacjentów hematologicznych w poszczególnych itemach Skali SWLS.
Table 2. Average ratings for individual areas of life in the Questionnaire of Satisfaction presented by hematologic patients (N=41) at the time of the study and prior to the disease

<table>
<thead>
<tr>
<th>No.</th>
<th>Evaluated areas in life</th>
<th>At present</th>
<th>Before the disease</th>
<th>Differences between the averages</th>
<th>Rank</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>My financial situation</td>
<td>3.06</td>
<td>3.65</td>
<td>0.59</td>
<td>6</td>
<td>3.32</td>
<td>0.002</td>
</tr>
<tr>
<td>2</td>
<td>My health</td>
<td>2.06</td>
<td>3.59</td>
<td>1.53</td>
<td>1</td>
<td>4.15</td>
<td>0.000</td>
</tr>
<tr>
<td>3</td>
<td>My work</td>
<td>2.79</td>
<td>3.06</td>
<td>0.35</td>
<td>7</td>
<td>0.83</td>
<td>not significant</td>
</tr>
<tr>
<td>4</td>
<td>My relationship/marriage</td>
<td>3.88</td>
<td>4.06</td>
<td>0.18</td>
<td>9</td>
<td>1.37</td>
<td>not significant</td>
</tr>
<tr>
<td>5</td>
<td>My children</td>
<td>4.90</td>
<td>4.81</td>
<td>0.09</td>
<td>14</td>
<td>0.81</td>
<td>not significant</td>
</tr>
<tr>
<td>6</td>
<td>My satisfaction with myself</td>
<td>3.59</td>
<td>3.94</td>
<td>0.35</td>
<td>8</td>
<td>2.24</td>
<td>0.03</td>
</tr>
<tr>
<td>7</td>
<td>My sexual activity</td>
<td>1.71</td>
<td>2.65</td>
<td>0.94</td>
<td>2</td>
<td>2.39</td>
<td>0.02</td>
</tr>
<tr>
<td>8</td>
<td>My relations with others</td>
<td>4.06</td>
<td>4.24</td>
<td>0.18</td>
<td>11</td>
<td>2.09</td>
<td>0.04</td>
</tr>
<tr>
<td>9</td>
<td>My resourcefulness</td>
<td>3.41</td>
<td>4.24</td>
<td>0.83</td>
<td>3</td>
<td>3.01</td>
<td>0.004</td>
</tr>
<tr>
<td>10</td>
<td>My own achievements</td>
<td>3.41</td>
<td>3.65</td>
<td>0.24</td>
<td>10</td>
<td>1.00</td>
<td>not significant</td>
</tr>
<tr>
<td>11</td>
<td>My decisions</td>
<td>3.76</td>
<td>3.88</td>
<td>0.12</td>
<td>13</td>
<td>0.62</td>
<td>not significant</td>
</tr>
<tr>
<td>12</td>
<td>My appearance</td>
<td>2.94</td>
<td>3.56</td>
<td>0.62</td>
<td>5</td>
<td>3.65</td>
<td>0.000</td>
</tr>
<tr>
<td>13</td>
<td>My scope of tasks</td>
<td>3.47</td>
<td>4.12</td>
<td>0.65</td>
<td>4</td>
<td>3.01</td>
<td>0.005</td>
</tr>
<tr>
<td>14</td>
<td>My home</td>
<td>3.82</td>
<td>4.00</td>
<td>0.18</td>
<td>12</td>
<td>0.97</td>
<td>not significant</td>
</tr>
<tr>
<td></td>
<td>General SQ score</td>
<td>44.0</td>
<td>51.15</td>
<td>7.40</td>
<td>-</td>
<td>5.60</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Figure 2. Ratings for individual areas of life during hematological illness

Rycina 2. Oceny poszczególnych dziedzin własnego życia w czasie choroby hematologicznej
Figure 3. Ratings for individual areas of life before hematological illness

Among the fourteen assessed areas, the highest scores were found in relations with others (the only area with ratings over 4 on the 5-point scale). Other relatively well (>3.5) rated areas includes: "my home", "my decisions", "my relationship with a close person", and "my resourcefulness". The lowest scores were found in "my sexual activity", "my health" and "my work".

The same areas of life were assessed for the period before the disease, the answers being presented in Figure 3.

All ratings were definitely higher; however, the value of the scores was only slightly positive, and in a few categories it was even negative, particularly regarding satisfaction with sexual activity, one's work and health. Slightly more positive, barely above the neutral score, were the average ratings pertaining to one's financial situation, appearance and satisfaction with achievements.

Conclusions

The level of general satisfaction with life presented by patients diagnosed with leukemia does not differ from that found in healthy individuals. It seems that the primal need to exist, referred to as the instinct of existence, is stronger than the limitations and hazards resulting from a disease.¹

¹ Many authors emphasize the unusual stability of this criterion [10-12], which is of great consequence for comparative studies.
A considerable negative change was found in the assessment of satisfaction with all areas of one's life, but with a characteristic exception: the assessment of one's children. In most cases (8 out of 14) the scores pertaining to the present situation were statistically significantly different from the ratings of one's situation before the disease.

The greatest changes in the assessment of life before and after the disease were observed not only in the lower evaluation of one's health, but also the very low satisfaction with sexual activity, even dissatisfaction with resourcefulness and dealing with everyday tasks, as well as the unfavorable assessment of one's appearance and financial situation.

The most negative effects for the prognosis regarding the assessment of the quality of one's life resulted from a decreasing satisfaction with oneself. With time, the side effects of the therapy may further deepen the unfavorable change in that area. In that respect, the need for support from medical personnel is clearly visible, otherwise, depressive conditions may easily develop, and often suicidal thoughts may occur.

**Literature**

5. Juczyński Z. Narzędzia pomiaru w promocji i psychologii zdrowia. [Measuring tools in health promotion and psychology]
11. Schimmack U, Diener E, Oishi S. Life-satisfaction is a momentary judgment and a stable personality characteristic: The use of chronically accessible and stable sources. J Personality, 2002; 70: 345-384
AD Hyper-IgE syndrome – cutaneous manifestations in the medical practice of allergologists, dermatologists and immunologists. A case report

Zespół hiper-IgE autosomalny dominujący – manifestacje skórne w praktyce lekarza alergologa, dermatologa i immunologa – opis przypadku

Grażyna Sławeta1, Edyta Heropolitańska-Pliszka2, Barbara Pietrucha2, Ewa Bernatowska2

1Allergology Clinic in Starachowice; head of the Provincial Healthcare Facility: Sebastian Petrykowski
2Immunology Clinic, Department of Immunology at the Children’s Memorial Health Institute in Warsaw; head: Prof. Ewa Bernatowska MD, PhD

Abstract. Hyper-IgE (HIES) is a primary immune deficiency, first described in 1966 by Davis et al. It has very rare levels of occurrence (about 250 cases described in the world) and is characterized by a clinical triad of symptoms: elevated levels of serum IgE (>2000 IU/ml), recurrent staphylococcal skin abscesses, and severe recurrent pulmonary infections with pneumatocele formation. In the medical practices of allergologists, dermatologists and immunologists, it is a serious diagnostic and clinical problem. This paper presents the case of a 27-year-old patient with AD Hyper-IgE syndrome (AD HIES) confirmed by genetic tests (dominant mutation in STAT3 gene) and characteristic skin lesions, such as recurrent “cold” staphylococcal abscesses, atopics like dermatitis, systemic abscesses (abscesses of liver), history of staphylococcal sepsis, numerous chalazions and phlegmonous acne (face and back). In HIES it is important to make an early diagnosis and to implement proper treatment involving prophylactic antibiotics and antifungal drugs.

Key words: hyper-IgE syndrome (AD HIES), cold abscesses, staphylococcal infections, STAT3

Streszczenie. Zespół hiper-IgE (HIES) to pierwotny niedobór odporności opisany po raz pierwszy przez Davis i wsp. w 1966 r. Występuje bardzo rzadko (ok. 250 przypadków na świecie). HIES charakteryzuje się triadą objawów, która pojawia się we wczesnym dzieciństwie: dużym stężeniem IgE w surowicy (>2000 IU/ml), nawracającymi zakażeniami ropnymi skóry, ropniami wywołanymi przez gronkowce i ciężkimi nawracającymi zapałeniami płuc z pneumatocele. W praktyce lekarskiej alergologa, dermatologa oraz immunologa stanowi poważny problem diagnostyczny i kliniczny. W artykule przedstawiono przypadek 27-letniego pacjenta z zespołem AD hiper-IgE potwierdzonym badaniami genetycznymi (dominująca mutacja w genie STAT3) i z występowaniem charakterystycznych zmian skórnych: zimnych ropni, zakażeń ropnych wywołanych przez gronkowce, zmian wypryskowych przypominających AZS oraz ropni narządowych (ropni wątroby), przebytych posocznic o etiologii gronkowcowej, licznych gradówek i trądziku ropowiczego (twarz, plecy). W zespole hiper-IgE (HIES) ważne jest wczesne rozpoznanie i wdrożenie właściwego leczenia: profilaktycznej antybiotykoterapii oraz leków przeciwporycznych.

Słowa kluczowe: zespół hiper-IgE, zimne ropni, zakażenia gronkowcowe, STAT3

Delivered: 12/10/2015
Accepted for print: 01/12/2015
Copyright by Military Institute of Medicine

Corresponding author
Grażyna Sławeta MD, PhD
Allergology Clinic
70 Radomska St. 27-200 Starachowice
telephone: +48 600 996 033
e-mail: gslaweta@poczta.onet.pl
Introduction

Hyper-IgE syndrome is a primary immune deficiency, first described in 1966 by Davis et al. The patients were two girls with pale complexions and red hair suffering from eczema, nail dystrophy, sinus and respiratory infections as well as recurrent skin staphylococcal abscesses [1]. Hyper-IgE syndrome is an extremely rare condition (<10^6 births) and is characterized by a triad of symptoms occurring in early childhood: elevated levels of serum IgE (>2000 IU/ml), recurrent staphylococcal skin abscesses and severe recurrent pneumonia [2-5]. Around 250 cases of HIES in the world have been described to date [6, 7].

The name of the condition – “Job syndrome” is a reference to the biblical story of Job, who, by Satan’s curse, was covered with skin lesions, described as “acute leprosy”, similar to those found in HIES [1]. The condition is found in different ethnic groups, with no gender predilection. Two models of the syndrome are distinguished: autosomal dominant (AD HIES) and autosomal recessive (AR HIES).

The autosomal dominant variant of the disease is caused by an inactivating mutation of the STAT3 gene, a defect located in the 4q chromosome [2, 6]. The majority of cases of the autosomal recessive variant of the disease is caused by a mutation of the DOCK8 (dedicator of cytokinesis 8) gene. Two cases of autosomal recessive HIES caused by the mutation of tyrosine kinase TYK2 have also been described [2]. The AR HIES and AD HIES variants are clinically different.

The autosomal dominant variant is characterized by recurrent pneumonias with the formation of pneumatocele and craniofacial abnormalities such as tooth abnormalities and delayed loss of deciduous teeth, as well as severe tooth caries with gangrenous pulpitis [5, 8, 9]. More than half of the patients suffer from frequent long bone fractures [6], rib fractures, and less frequently vertebral fractures [10]. Scoliosis and recurrent chalazia have also been reported [11]. The characteristic appearance of the patients includes thick facial features, rough skin, deep eye setting, protruding forehead, prognathism, thick lower lip and ears, wide nose, and, in a number of female patients, red hair and pale complexion [1, 5, 6, 12]. Neurological disorders and thoracic aortic aneurysms are observed in adult patients.

In the AR variant of the disease, contrary to the AD variant, serious viral infections are commonly observed. Lymphopenia is predominant, with the depletion in T line lymphocytes. Stem cell transplants from the peripheral blood is necessary; however, bone anomalies, fractures, dental abnormalities and characteristic facial features are not observed [13].

Skin lesions in AD HIES occur in the first days or months of life of the patient, and take the form of neonatal rash, pustulo-eczematous lesions (atopic like dermatitis) or recurrent bacterial infections of staphylococcal origin. The so-called cold abscesses have no characteristic inflammatory symptoms such as redness, increased temperature or tenderness, and are pathognomonic for hyper-IgE syndrome, but are not necessary for the diagnosis [1, 4, 6, 14-17].

The diagnosis can be challenging for allergologists, dermatologists and immunologists because of the clinical picture, which is similar to other childhood conditions such as atopic or seborrhoeic dermatitis.

We present a case of a 27-year-old male patient diagnosed with AD HIES (positive genetic testing at the age of 22). The patient showed characteristic skin lesions with the pathognomonic "cold abscesses", organ abscesses, as well as pneumatocele, frequent infections of the respiratory system (throat, bronchi and lungs). He also suffered from tooth caries, delayed loss of deciduous teeth and staphylococcal sepsis as well as pathological fractures of long bones.

Case report

The patient was born as a first child (first pregnancy) in due time. His parents were young and healthy, and they were not related. At the age of 2 months he was admitted to hospital due to sepsis of Staphylococcus epidermidis origin, with bilateral pneumonia and bacterial infection of multiple skin lesions. At the age of 3 months, a skin rash appeared on the face, and soon it spread to the rest of patient's body. At the age of 4 months another episode of bilateral pneumonia happened; this time it was of Pseudomonas aeruginosa origin with an accompanying urinary tract infection. In the 6th month of life, the patient went into bacterial sepsis of Staphylococcus aureus origin with multiple purulent skin lesions. In the 11th month of life, the patient was diagnosed with severe pneumoencephalitis due time. His parents were young and healthy, and they were not related. At the age of 2 months he was admitted to hospital due to sepsis of Staphylococcus epidermidis origin, with bilateral pneumonia and bacterial infection of multiple skin lesions. At the age of 3 months, a skin rash appeared on the face, and soon it spread to the rest of patient's body. At the age of 4 months another episode of bilateral pneumonia happened; this time it was of Pseudomonas aeruginosa origin with an accompanying urinary tract infection. In the 6th month of life, the patient went into bacterial sepsis of Staphylococcus aureus origin with multiple purulent skin lesions. In the 11th month of life, the patient was diagnosed with severe pneumoencephalitis due time. His parents were young and healthy, and they were not related. At the age of 2 months he was admitted to hospital due to sepsis of Staphylococcus epidermidis origin, with bilateral pneumonia and bacterial infection of multiple skin lesions. At the age of 3 months, a skin rash appeared on the face, and soon it spread to the rest of patient's body. At the age of 4 months another episode of bilateral pneumonia happened; this time it was of Pseudomonas aeruginosa origin with an accompanying urinary tract infection. In the 6th month of life, the patient went into bacterial sepsis of Staphylococcus aureus origin with multiple purulent skin lesions. In the 11th month of life, the patient was diagnosed with severe pneumoencephalitis due time. His parents were young and healthy, and they were not related. At the age of 2 months he was admitted to hospital due to sepsis of Staphylococcus epidermidis origin, with bilateral pneumonia and bacterial infection of multiple skin lesions. At the age of 3 months, a skin rash appeared on the face, and soon it spread to the rest of patient's body. At the age of 4 months another episode of bilateral pneumonia happened; this time it was of Pseudomonas aeruginosa origin with an accompanying urinary tract infection. In the 6th month of life, the patient went into bacterial sepsis of Staphylococcus aureus origin with multiple purulent skin lesions. In the 11th month of life, the patient was diagnosed with severe pneumoencephalitis due time. His parents were young and healthy, and they were not related. At the age of 2 months he was admitted to hospital due to sepsis of Staphylococcus epidermidis origin, with bilateral pneumonia and bacterial infection of multiple skin lesions. At the age of 3 months, a skin rash appeared on the face, and soon it spread to the rest of patient's body. At the age of 4 months another episode of bilateral pneumonia happened; this time it was of Pseudomonas aeruginosa origin with an accompanying urinary tract infection. In the 6th month of life, the patient went into bacterial sepsis of Staphylococcus aureus origin with multiple purulent skin lesions. In the 11th month of life, the patient was diagnosed with severe pneumoencephalitis due time. His parents were young and healthy, and they were not related. At the age of 2 months he was admitted to hospital due to sepsis of Staphylococcus epidermidis origin, with bilateral pneumonia and bacterial infection of multiple skin lesions. At the age of 3 months, a skin rash appeared on the face, and soon it spread to the rest of patient's body. At the age of 4 months another episode of bilateral pneumonia happened; this time it was of Pseudomonas aeruginosa origin with an accompanying urinary tract infection. In the 6th month of life, the patient went into bacterial sepsis of Staphylococcus aureus origin with multiple purulent skin lesions. In the 11th month of life, the patient was diagnosed with severe pneumoencephalitis due time. His parents were young and healthy, and they were not related. At the age of 2 months he was admitted to hospital due to sepsis of Staphylococcus epidermidis origin, with bilateral pneumonia and bacterial infection of multiple skin lesions. At the age of 3 months, a skin rash appeared on the face, and soon it spread to the rest of patient's body. At the age of 4 months another episode of bilateral pneumonia happened; this time it was of Pseudomonas aeruginosa origin with an accompanying urinary tract infection. In the 6th month of life, the patient went into bacterial sepsis of Staphylococcus aureus origin with multiple purulent skin lesions. In the 11th month of life, the patient was diagnosed with severe pneumoencephalitis due time.
sepsis. Antistaphylococcal (trimethoprim with sulphemetoxazole) and antifungal (ketoconazole) prophylaxis was introduced.

In the following 18 years the patient had three episodes of organ abscesses (twice in the liver, and one episode of an abscess of the right lung, with following formation of pneumatocele), about 20 episodes of skin abscesses differently located (Fig. 1), including 12 requiring surgical intervention, 15 incidents of bronchitis and pharyngitis, about 8 incidents of chalazion and multiple incidents of bacterial infections of skin lesions (Fig. 2), including purulent acne of face and back requiring antibiotic therapy. The patient also experienced several incidents of massive oral candidiasis (Fig. 3) and 4 incidents of bone fractures with no trauma (right lower extremity, clavicle and left upper extremity (2 times)). A dental examination at the age of 20 revealed severe tooth caries, as well as 4 over-retained deciduous teeth. At the age of 22, a genetic test proved the etiology of patient's condition to be a dominant mutation of the STAT3 gene. As for now, the patient receives a prophylactic therapy of sulphometoxazol and trimethoprim, as well as itraconazole.

**Discussion**

It is important to diagnose the hyper-IgE syndrome at an early stage, as it is crucial for proper management of the dermatological, pulmonological and dental complications. It is also important for early introduction of antistaphylococcal and antifungal prophylaxis.

A wide range of skin lesions can appear in the progress of the disease, thus it is necessary to examine the skin of the patient and obtain a medical history of atopic conditions in the patient's family so as not to confuse HIES with atopic dermatitis. Apart from skin lesions, patients with the hyper-IgE syndrome typically reveal serious infections and complications concerning other systems, which increase with age. Every patient should be tested for serum IgE level on a regular basis, as well as for blood count (with special attention to the number of lymphocytes and eosinophils). Genetic and immunological testing should also be performed.

Patients with atopic dermatitis also have an increased concentration of IgE antibodies. However, they often complain of increased pruritus, and the atopic dermatitis has a number of concurrent atopic conditions such as bronchial asthma (30-50%), allergic rhinitis (4%), acute urticaria (11%) and allergic conjunctivitis. These three conditions can appear concurrently [18, 19].
Diagnosis of atopic dermatitis is still made based on the criteria developed by Hanifin and Rajka in 1980. Correct diagnosis requires the presence of at least 3 of the 4 major criteria and at least 3 minor criteria (Tab. 1) [20]. The minor criteria have a significant supplementary value.

Allergens which play an important role in atopic dermatitis are mainly food allergens (cow milk proteins, eggs, citrus fruit, tomatoes, nuts, etc.) as well as aeroallergens (house dust, house dust mites, mold, as well as pollen of grasses, trees, weeds, etc.) [18, 19].

Due to a defect of the epithelial barrier (ectodermal defect) and frequent contact with local drugs and emollients, patients with atopic dermatitis have an increased risk of developing contact eczema upon contact with allergens in their environment.

Infective agents are also common. Staphylococcus aureus occurs in 75-100% of skin lesions in untreated patients with atopic dermatitis and in 30-50% cases in non-affected skin regions [19, 21]. These infections are more likely to develop in the presence of skin damage, such as neurotic excoriations and erosions. Microorganisms, their proteins and toxins (superantigens) can stimulate and sustain inflammatory processes in atopic dermatitis [21].

Atopic dermatitis has three variants: <2 years old – the infant variant, <12 years old – the childhood variant and the adolescent and adult variant [22].

In the progress of hyper-IgE syndrome there is, however, a triad of symptoms, which occurs in 75% of all patients, and in 85% of patients older than 8 years:
- eczema and recurrent abscesses of skin, hypodermis and internal organs (lungs, liver, bones, joints, lymph nodes),
- recurrent airway inflammation,
- elevated total IgE level.

In infancy, severe pneumonias (caused by Staphylococcus aureus) are observed, together with lung abscesses, broncho-pleural fistulas and pneumatocele (which may lead to Pseudomonas aeruginosa or Aspergillus fumigatus colonization) [23, 24].

Purulent skin and lung infections can exist without signs of inflammation and fever. Hence their name – “cold abscesses”. The lesions often occur on the scalp [20]. Dystrophic nails are often observed, frequently infected with Candida albicans [25].

The diagnostic process of hyper-IgE involves determination of serum IgE, which is increased to >2,000 IU/ml, and in some cases to >100,000 IU/ml. Eosinophilia in the peripheral blood of more than 700 cells/ml is characteristic for the condition [6]. Additionally, bacteriological testing of swabs from the skin, nasal cavity, throat and fluid obtained from bronchial lavage (if necessary) can have a diagnostic value, both with regard to bacteria and fungi.

Table 1. Diagnostic criteria for Atopic Dermatitis according to Hanifin and Rajka (1980)

<table>
<thead>
<tr>
<th>major criteria</th>
<th>minor criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>• pruritus</td>
<td>• xerosis</td>
</tr>
<tr>
<td>• typical localization (age specific)</td>
<td>• keratosis pilaris</td>
</tr>
<tr>
<td>• chronic and recurrent history</td>
<td>• ichthyosis</td>
</tr>
<tr>
<td>• atopy in personal or family medical history</td>
<td>• type I hypersensitivity; increased IgE</td>
</tr>
<tr>
<td></td>
<td>• early onset of disease</td>
</tr>
<tr>
<td></td>
<td>• impaired cell-mediated immunity and susceptibility to skin infections</td>
</tr>
<tr>
<td></td>
<td>• susceptibility to non-specific hand dermatitis</td>
</tr>
<tr>
<td></td>
<td>• mastitis</td>
</tr>
<tr>
<td></td>
<td>• cheilitis actinica</td>
</tr>
<tr>
<td></td>
<td>• recurrent conjunctivitis</td>
</tr>
<tr>
<td></td>
<td>• Dennie-Morgan infraorbital fold</td>
</tr>
<tr>
<td></td>
<td>• keratoconus</td>
</tr>
<tr>
<td></td>
<td>• anterior cataract</td>
</tr>
<tr>
<td></td>
<td>• discoloring of eyelids and skin around the eyes</td>
</tr>
<tr>
<td></td>
<td>• facial erythema</td>
</tr>
<tr>
<td></td>
<td>• pityriasis alba</td>
</tr>
<tr>
<td></td>
<td>• itch when sweating</td>
</tr>
<tr>
<td></td>
<td>• thickening of neck folds</td>
</tr>
<tr>
<td></td>
<td>• wool intolerance</td>
</tr>
<tr>
<td></td>
<td>• food intolerance/history of food allergy</td>
</tr>
<tr>
<td></td>
<td>• exacerbation following emotional stress</td>
</tr>
<tr>
<td></td>
<td>• white dermographism/decreased sweating</td>
</tr>
<tr>
<td></td>
<td>• hypersensitivity to common allergens</td>
</tr>
</tbody>
</table>
Concentrations of major classes of immunoglobulins, as well as IgG subclasses and basic subpopulations of lymphocytes, should be tested. In the early stages of the disease the NBT test should be performed, to differentiate HIES from chronic granulomatous disease. Alternatively, granulocytes with NADPH oxydase should be analyzed with the use of a cytometric method.

The final diagnosis is confirmed or ruled out by genetic testing towards microdeletions in the 4q chromosome – heterozygotic de novo mutation of the STAT3 gene.

A skin biopsy with histological examination is a useful tool for differentiating diagnosis. In HIES, the skin biopsy reveals an eosinophilic infiltration, similar to the one observed in eosinophilic folliculitis [14]. In atopic dermatitis, the histological image depends on the morphology of changes, and takes the form of exudative eczema or lichenization. Lymph nodes reveal reactive changes [22].

A scoring system developed by Grimbacher (Tab. 2) is a useful tool for the diagnosis of HIES, taking account of both the clinical and laboratory criteria of the hyper-IgE syndrome. A total score of <15 points means that the patient is not a carrier of the hyper-IgE genotype. A score of 16-39 points makes the diagnosis of the diseases probable. A score of 40-59 makes the presence of the disease and >60 makes the diagnosis certain.

Diagnosing HIES in the first days of patient's life is difficult, as a number of other conditions, including atopic dermatitis [22, 26, 27] and other atopic conditions, feature increased levels of IgE (Tab. 3) [27].

Treatment of HIES is based on prophylactic and therapeutic antibiotic therapy (with oral penicillin and trimethoprim with sulphometoxasol) as well as antifungal prophylaxis aimed at not only *Candida* species but also *Aspergillus* [6].

Proper skin care is of great importance in HIES patients [6]. Skin abscesses are often located in the anterior neck region and contain up to 200 ml of pus (size of 6 to 10 cm). The abscesses are mostly of *Staphylococcus aureus* origin and require surgical intervention with drainage. The treatment also includes antibiotics (local and systemic) and local disinfectants such as chlorhexidine [16, 25].

Systemic antibiotic therapy is used for acute skin lesions and *Staphylococcus aureus* infections. Local steroids used in creams and ointments do not have any effect on skin lesions, contrary to antibiotic prophylaxis, which differentiates HIES from atopic dermatitis [6]. In around 60% of HIES patients, a chronic candidosis of skin and mucosa can be found. This is characteristic for STAT3 deficiency, and in HIES patients manifests by aphthae, vaginal candidosis and onychomycosis. In half of the HIES patients, a chronic paronychia involves more than one nail [20, 25].

Systemic *Candida* infection is extremely rare. In patients with respiratory fungal infections caused by *Aspergillus fumigatus*, increasing the prophylactic dose of itraconazole may not be sufficient, and voriconazole or posaconazole should be used in that case [16, 25].

There have been attempts to use isotretynoin [28], cyclosporin [29], plasmaferesis [30] and bone marrow stem cells transplantation [31, 32] in more severe cases. However, they were not successful.

There were also attempts of using immunoglobulins, which according to some researchers were successful [33, 34]. Others observed no such success [35]. Omalizumab was also used with some effect [36].

Hyper-IgE patients, similarly to other patients with inborn immunity disorders, are more likely to suffer from autoimmune diseases such as systemic lupus erythematous (SLE) or dermatomyositis (DM) [37]. They are also more prone to certain neoplasms such as non-Hodgkin's lymphomas [38] and Hodgkin's disease [39]. This is probably related to constant stimulation of the immune system cells by bacterial antigens [6, 39].

**Conclusions**

A HIES patient needs comprehensive and multi-disciplinary help from a team of physicians: pediatrics, general practitioners, dermatologists, allergologists, pulmonologists, surgeons, orthopedic surgeons, neurologists, dentists and oncologists, as well as clinical immunologists. All of these physicians should have the proper knowledge and awareness of this condition and its symptoms and diagnostic process. It is important to be aware of the necessity for prophylactic antibiotic therapy.

Due to the risk of autoimmune disorders and lymphoreticular neoplasms, the patient should remain under medical care for the rest of their life.
Table 2. Scoring system in AD HIES based on clinical and laboratory findings (according to Grimbacher et al.)

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>highest serum IgE level (IU/ml) [N: &lt;130 IU/ml]</td>
<td>0</td>
</tr>
<tr>
<td>skin abscesses</td>
<td>200-500</td>
</tr>
<tr>
<td>pneumonias (number of episodes)</td>
<td>501–1000</td>
</tr>
<tr>
<td>lung parenchymal disorders</td>
<td>1001–2000</td>
</tr>
<tr>
<td>other serious infections</td>
<td>&gt;2000</td>
</tr>
<tr>
<td>highest number of eosinophils (cells/μl)</td>
<td>&lt;700</td>
</tr>
<tr>
<td>neonatal rash</td>
<td>700-800</td>
</tr>
<tr>
<td>eczema (worst episode)</td>
<td>&gt;800</td>
</tr>
<tr>
<td>sinusitis, otitis (incidents per year)</td>
<td>1-2</td>
</tr>
<tr>
<td>candidiasis</td>
<td>3</td>
</tr>
<tr>
<td>over-retained deciduous teeth</td>
<td>4-6</td>
</tr>
<tr>
<td>scoliosis, max.</td>
<td>&gt;6</td>
</tr>
<tr>
<td>joint hyperflexion</td>
<td>1-2</td>
</tr>
<tr>
<td>characteristic facial features</td>
<td>3</td>
</tr>
<tr>
<td>wide nose basis</td>
<td>2</td>
</tr>
<tr>
<td>highly arched palate</td>
<td>3</td>
</tr>
<tr>
<td>midline abnormalities</td>
<td>&gt;3</td>
</tr>
<tr>
<td>lymphoma</td>
<td>present</td>
</tr>
<tr>
<td>age (years)</td>
<td>&gt;5</td>
</tr>
</tbody>
</table>

Literature

Table 3. Differentiation hyper-IgE
Tabela 3. Różnicowanie zespołu hiper-IgE

<table>
<thead>
<tr>
<th>allergic diseases</th>
<th>atopic dermatitis</th>
<th>bronchopulmonary aspergillosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>neoplasms</td>
<td>IgE myeloma</td>
<td>Hodgkin’s disease</td>
</tr>
<tr>
<td>primary immunity deficiencies</td>
<td>Netherton syndrome</td>
<td>Wiskott-Aldrich syndrome</td>
</tr>
<tr>
<td>secondary immunity deficiencies</td>
<td>HIV</td>
<td></td>
</tr>
</tbody>
</table>

15. Freeman AF. Clinical manifestations of hyper IgE syndromes. Dis Markers, 2010; 29 (3-4): 123-130
21. Nowicki R. Rolę infekcji w zespole atopowego zapalenia skóry (wypukłym atopowym) [The role of infection in atopic dermatitis syndrome (atopic eczema)]. Przegl Alergo, 2005; 1: 30-34
27. Nowicka U. Choroby i stany przebiegające z podwyższonym stężeniem immunoglobuliny E w surowicy [Diseases and conditions with increased serum IgE]. Pneumonol Alergor Pol, 2009; 77: 533-540
Familial hypocalciuric hypercalcaemia in the differential diagnostics of hypercalcaemia in adults

Rodzinna hiperkalcemia hipokalciuryczna w diagnostyce różnicowej hiperkalcemii u dorosłych

Anna Kłosińska

Department of Internal Diseases, 10th Military Clinical Hospital with Polyclinic at the Independent Public Healthcare Centre in Bydgoszcz; head: Col. Krzysztof Komorowski MD, PhD

Abstract. Familial hypocalciuric hypercalcaemia is an uncommon cause of hypercalcaemia in adults. It is most often caused by a heterozygotic inactivating mutation of the calcium sensing receptor gene, which leads to a decrease in the sensitivity of the parathyroid cells and renal tubules to increasing calcium serum levels. In consequence, hypercalcaemia and hypocalciuria occur although the parathormon serum level remains normal or is only modestly increased. Familial hypocalciuric hypercalcaemia proceeds mostly without any significant clinical symptoms. Calcium to creatinine clearance ratio is the most useful parameter in the laboratory diagnostics of familial hypocalciuric hypercalcaemia, which for familial hypocalciuric hypercalcaemia is <0.01. Confirmation of the inactivating mutation of the calcium sensing receptor gene is crucial for the diagnosis. Generally, familial hypocalciuric hypercalcaemia does not need a specific treatment. Its basic clinical significance is the differentiation between familial hypocalciuric hypercalcaemia and the most common causes of hypercalcaemia, such as primary hyperparathyroidism and malignant neoplasms. The correct diagnosis of familial hypocalciuric hypercalcaemia protects patients from undergoing parathyroidectomy or invasive oncological diagnostics, and the related complications.

Key words: calcium sensing receptor, familial hypocalciuric hypercalcaemia, hypercalcaemia, primary hyperparathyroidism

Streszczenie. Rodzinna hiperkalcemia hipokalciuryczna jest jedną z rzadziej występujących przyczyn hiperkalcemii u dorosłych. Najczęściej spowodowana jest heterozygotyczną mutacją inaktywującą genu receptoru wapniowego, co prowadzi do zmniejszenia wrażliwości komórek przytarczyc oraz cewek nerkowych na zwiększenie stężenia wapnia w surowicy. W wyniku tego dochodzi do hiperkalcemi i hipokalciurii przy prawidłowym lub nieznacznie tylko zwiększonym stężeniu parathormonu w surowicy. Rodzinna hiperkalcemia hipokalciuryczna najczęściej przebiega bez uchwytnych objawów klinicznych. W diagnostyce laboratoryjnej najbardziej pomocnym parametrem jest stosunek klirensu wapnia do klirensu kreatyniny, w przypadku rodzinnej hiperkalcemii hipokalciurycznej wynoszący <0,01. O ostatecznym rozpoznaniu decyduje jednak stwierdzenie mutacji inaktywującej genu receptoru wapniowego. Rodzinna hiperkalcemia hipokalciuryczna najczęściej nie wymaga swoistego leczenia. Jej podstawowe znaczenie kliniczne polega na różnicowaniu z częściej występującymi przyczynami hiperkalcemi, takimi jak pierwotna nadczynność przytarczyc, takimi jak pierwotna nadczynność przytarczyc czy nowotwory złośliwe. Rozpoznanie rodzinnej hiperkalcemii hipokalciurycznej pozwala oszczędzić pacjentom niepotrzebnej paratyreidektomii lub inwazyjnej diagnostyki onkologicznej oraz związanych z tym powikłań.

Słowa kluczowe: rodzinna hiperkalcemia hipokalciuryczna, hiperkalcemia, primary hyperparathyroidism

Introduction

Hypercalcaemia is an elevated serum calcium level of over 2.75 mmol/l (11 mg/dl). A total of 90% of all hypercalcaemia cases in adults are caused by neoplasms and adrenal hyperparathyroidism. Differential diagnostics of hypercalcaemia also covers numerous rare diseases, and excluding them is important from a clinical point of view as it allows one to avoid unnecessary parathyroidectomy as well as extensive, often invasive, diagnostics aimed at the exclusion of a neoplastic disease. One such disease is familial hypocalciuric hypercalcaemia (FHH), also referred to as familial benign hypercalcaemia (FBH) [27]. It is a rare, genetically conditioned disease associated with asymptomatic hypercalcaemia and usually does not require treatment. It is estimated that patients with FHH constitute about 2%
of all patients diagnosed due to hypercalcemia [26]. In one study, the FHH frequency was estimated at 1 in 78,000 people (western Scotland) [36].

**Role of calcium sensing receptor in calcium homeostasis regulation and the pathophysiologic consequences of its disturbed function**

The calcium sensing receptor (CaSR) is located in the cells of the parathyroid glands, distal renal tubules, skeletal muscles and bones, thyroid C-cells, gastrointestinal tract and in many regions of the brain, such as the hippocampus, cerebellum and hypothalamus [1, 2, 7, 10, 33, 37]. In physiological conditions, increased serum calcium concentration leads, through this receptor, to a reduced parathormone secretion by the parathyroid gland cells, and to reduced renal tubular calcium reabsorption, resulting in increased calcium excretion in the urine [1, 2]. The role of the calcium sensing receptor in the bone tissue is still open to discussion [15]. In primary hyperparathyroidism the calcium sensing receptor expression in parathyroid cells is reduced, and thus increased serum calcium levels do not lead to an inhibition of parathormone secretion, and its concentration rises [1]. In most cases of familial hypocalciuric hypercalcemia, a heterozygous inactivating mutation occurs in a CASR gene [1, 31]. As a result of the loss of function in one of the alleles of the CASR gene, in familial hypocalciuric hypercalcemia the parathyroid cells and renal tubular cells demonstrate a reduced sensitivity to calcium, which leads to hypercalcemia and hypocalciuria [1, 2, 31]. Parathormone concentration remains normal, or slightly elevated [1, 3]. In FHH the reabsorption of magnesium ions by renal tubules is also increased [12]. Homozygous mutation of the CASR gene, meaning a loss of function in both alleles, results in severe primary hyperparathyroidism in newborns (neonatal severe primary hyperparathyroidism, NSHPT), which may be fatal if parathyroidectomy is not performed early [1, 4, 31]. The heterozygous activating mutation of the CASR causes increased sensitivity of the parathyroid cells and renal tubular cells to calcium; as a result, even relatively low calcium concentrations lead to inhibition of parathormone secretion and a relative hypercalcuria. This is an underlying mechanism in congenital hypoparathyroidism inherited in the autosomal dominant mode (ADH) [1, 2].

**Etiopathogenesis of familial hypocalciuric hypercalcemia**

Familial hypocalciuric hypercalcemia is usually caused by a mutation which reduces CASR sensitivity, resulting in insufficient inhibition of parathormone secretion from the parathyroid cells in response to calcium ions. The mutation is inherited in an autosomal dominant mode. Recent studies have demonstrated that familial hypocalciuric hypercalcemia is caused not only by mutations directly affecting the CASR gene. According to the mutation type, three types of FHH were distinguished. In the most common, type 1 FHH the mutation affects the CASR gene located on the 3q21.1 chromosome [1, 6]. In type 2 FHH, the mutation affects the GNA11 gene, which codes subunit alpha 11 of protein G, located on the 19p13.3 chromosome, whereas in type3 FHH, it affects the AP2S1 gene, which codes adaptor protein 2 sigma 1, located on the 19q13.3 chromosome [1, 7]; the mechanism in which the loss of their function affects CASR expression requires further research [1].

Rare cases of acquired hypocalciuric hypercalcemia due to the presence of calcium receptor autoantibodies are also reported [7-9]. Patients suffering from this disorder, similarly to FHH patients, demonstrate limited hypercalcemia, hypocalciuria and normal, or only slightly elevated parathormone concentration; however, they do not develop the mutations peculiar to FHH [8, 15]. Acquired hypocalciuric hypercalcemia presents symptoms more often than FHH [9]. Apart from hypercalcemia, the patients may experience symptoms of autoimmune comorbidities, such as autoimmune thyroiditis or hypophysitis, celiac disease, psoriasis, uveitis or rheumatoid arthritis [8, 15].

**Clinical image of FHH**

FHH in most cases is asymptomatic [7]. Literature data are rather inconsistent in that respect: according to certain sources, some FHH patients may experience limited muscle weakness and slightly increased fatigue [10], general weakness, headache and articular pains [15], polydipsia [26], as well as vertigo, restlessness, muscle sensitivity, problems with memory, and an increased tendency for tartar formation [12, 13].
Limited disorders of the skeletal muscle function may remain unnoticed by the patient, as the condition persists throughout his/her life [7]. A study by Jakobsen et al. demonstrated that FHH does not cause a significant reduction in muscular strength, physical fitness or quality of life, compared to healthy people [7]. The slightly critical Heath’s approach to the symptomatology of FHH seems reasonable: clinical symptoms are usually observed in patients whose serum calcium concentration is tested to explain their symptoms (and abnormal test results lead to further screening tests for FHH (family member testing) patients do not reveal any significant symptomatology, compared to their healthy relatives [38].

Typical abnormalities found in laboratory tests in familial hypocalciuric hypercalcaemia include mild hypercalcaemia, hypocalciuria, calcium clearance to creatinine clearance ratio <0.01, and normal or slightly elevated plasma parathormone concentration. Serum calcium concentration in FHH patients usually is not more than 10% above the upper limit of normal [21, 22, 26]. Serum magnesium concentration is within, or slightly above, the upper normal limit [26]. In FHH patients the increased activity of alkaline phosphatase has also been found [16, 18]. Serum monomer-like calciitonin concentration is reduced both at baseline and after an oral calcium loading test [27]. There are large differences in the phenotypic expression of FHH in individual families: in some patients it is incomplete – in those patients hypocalciuria does not occur, whereas in other families phenotypic features are more expressed, and the clinical picture resembles mild cases of primary hyperparathyroidism [15]. The calcium clearance to creatinin clearance ratio (fractional excretion of calcium in urine) is estimated according to a common formula:

$$\text{CaCl}/\text{Cr.Cl} = (u\text{-Ca} \times \text{V}/s\text{-Ca})/(u\text{-Cr} \times \text{V}/s\text{-Cr}) = (u\text{-Ca} \times \text{s-Cr})/(u\text{-Cr} \times s\text{-Ca})$$ [16]

where: CaCl. = calcium clearance, Cr.Cl. = creatinine clearance, u-Ca = calcium concentration in daily urine sample, V = volume of daily urine sample, s-Ca = serum calcium concentration (expressed in mg/dl), u-Cr. = creatinine concentration in a daily urine sample, s-Cr = creatinine concentration (expressed in mg/dl).

In about 80% of FHH patients the ratio is <0.01 [10, 16, 21, 24, 26], and such values are also found in patients treated with thiazide diuretics or lithium salts, which in those cases can lead to a misdiagnosis of FHH [26]. In FHH patients under basic conditions the 25-dihydroxyvitamin D concentration is normal, considering typical seasonal variations, whereas the 1,25-dihydroxyvitamin D concentration is slightly elevated in comparison to healthy individuals [5]. It was also observed that in FHH patients, contrary to healthy individuals and patients with primary hyperparathyroidism, the 1,25-dihydroxyvitamin D concentration does not increase significantly following oral supplementation of 25-hydroxyvitamin D [27]. This may be due to three possible mechanisms: direct inhibition of 1-alpha-hydroxylase by hypercalcaemia,
increased metabolic clearance of 1,25-dihydroxyvitamin D, and reduced stimulation of 1-alpha-hydroxylase due to persisting low calcitonin concentration [27]. In the rare type 3 FHH, hypophosphatemia and osteomalacia also occur besides hypercalcemia, hypocalciuria and elevated serum parathormone concentration [15]. Imaging tests do not reveal any abnormalities in most FHH patients [31, 41]. In the majority of patients with FHH parathyroid hyperplasia develops; however, usually no other specific histological changes are found apart from enlarged glands [10, 26].

Complications in FHH are rarely observed. They include chondrocalcinosis, premature vascular calcification, cholelithiasis and recurring acute pancreatitis [16, 21, 23, 26, 38]. Despite a tendency for premature vascular calcification, no increase in the frequency of cardiovascular incidents was observed in FHH patients in comparison to the general population [26].

There have been reports of osteoporosis in some families with FHH, but the condition does not seem to be characteristic of this disease [16, 17, 40]. In the majority of FHH patients, elevated parathormone concentration is not associated with the loss of bone tissue [16, 18, 20], and densitometry test results are normal, despite the slightly increased bone turnover observed in these patients [5, 40]. The frequency of fractures in FHH patients is not significantly elevated [40]. The incidence of osteopenia and cholelithiasis in FHH patients is comparable to the general population [26, 38]. The average life expectancy for patients diagnosed with FHH is the same as for the general population [26].

### Differentiation of FHH and primary hyperparathyroidism

In the majority of FHH cases the parathormone concentration is normal, or only slightly elevated compared to the values found in most patients with primary hyperparathyroidism [10]. In typical cases of primary hyperparathyroidism, hypercalcemia causes characteristic clinical symptoms, whereas FHH is a virtually asymptomatic condition. However, there are cases of mild primary hyperparathyroidism in which concentrations of parathormone, calcium and phosphates in the blood serum may be close to those observed in FHH [10, 31]. Contrary to primary hyperparathyroidism, in FHH hypermagnesemia frequently occurs [10]. Daily calcium excretion in the urine in FHH patients is usually not higher than 100 mg/24 h (25 mmol/24 h), whereas in primary hyperparathyroidism it is usually >120 mg/24 h [10]. The accepted limit value of the calcium clearance to creatinine clearance ratio in FHH is <0.01, while values over 0.02 suggest primary hyperparathyroidism [10, 25, 33]. However, there are reports of family members with FHH whose calcium excretion in the urine was normal or elevated; moreover, in patients with primary hyperthyroidism and concurrent vitamin D deficiency hypocaliuria can be observed [10]. Due to supplementation of vitamin D in primary hyperparathyroidism, calcium excretion with the urine increases, whereas in FHH it remains low [29]. In FHH, calcitriol concentration is usually normal, contrary to the elevated values observed in primary hyperparathyroidism [10]. In patients with FHH, similarly to primary hyperparathyroidism, disturbed growth hormone secretion is also found, which is probably due to a direct effect of hypercalcemia, as this abnormality also occurs in FHH patients with a normal parathormone concentration [30]. In primary hyperparathyroidism, a classic dehydration test reveals impaired renal concentration capacity, not found in FHH [33, 34]. The most important characteristics differentiating FHH from primary hyperparathyroidism are presented in Table 1.

### FHH diagnosis

An important diagnostic indicator is the occurrence of FHH in first-degree relatives [10]. However, due to the frequently asymptomatic course of the disease, it may not be detected in the patient's family [16]. FHH is most frequently diagnosed in individuals with hypercalcemia detected accidentally in laboratory tests performed for different reasons [10]. A patient's young age should also prompt diagnostics towards FHH [16]. The final diagnosis of FHH depends on the detection of the inactivating mutation of the calcium sensing receptor. Genetic tests for this mutation should be performed in all patients with calcium clearance to creatinine clearance ratio of <0.02; such a procedure enables FHH detection with a sensitivity of 98% [5]. However, a negative result of the test for CASR gene mutation does not exclude FHH completely, as about 10–30% of mutations are not detected by standard DNA sequencing techniques, and FHH may also be caused by mutations of genes other than CASR [26].

### Treatment

In most cases FHH does not require treatment [5]. Hypercalcemia in FHH does not respond to treatment with diuretics or bisphosphonates [26]. It has been reported that administration of cinacalcet at a dose of 30-60 mg/d to FHH patients results in improved well-being (in those patients with clinical symptoms) and normalization of biochemical parameters, such as total calcium concentration and ionized calcium concentration, serum magnesium and parathormone.
concentration, with good tolerance to the drug [12, 14]. Cinacalcet is an allosteric modulator of the calcium sensing receptor, it increases the receptor's sensitivity to changes in calcium concentration in the extracellular fluid, and the expression of the calcium sensing receptor. For many years it has been used successfully to treat primary and secondary hyperparathyroidism [12], therefore its use in FHH is justified from the pathophysiological and clinical point of view. However, the effect of cinacalcet treatment on the bone density assessed in a standard densitometric test has not been established [12].

**Clinical implications**

Cases of FHH with moderately elevated parathormone concentration require differentiation from mild cases of primary hyperparathyroidism [1]. Diagnosis of FHH in these cases allows patients to avoid unnecessary parathyroidectomy [7]. Parathyroidectomy in a FHH patient does not result in a cure, and persisting elevated serum calcium and parathormone concentrations found in follow-up tests, which incorrectly suggest chronic primary hyperparathyroidism, lead to further unnecessary surgeries, which increase the risk of post-operative hypoparathyroidism and recurrent laryngeal nerve injury [7].

In some young and adult FHH patients, parathyroid adenomas may develop, resulting in fully symptomatic primary hyperparathyroidism [10, 11, 28, 35]. In these patients parathyroidectomy does not lead to complete resolution of hypercalcemia, but allows a considerable reduction in its severity and associated clinical symptoms, as well as preventing the development of the typical complications of primary hyperparathyroidism [19].

As illustrated by the case of a female patient, diagnosed as a 45-year-old with FHH during the diagnostics of hypercalcemia, unresponsive to biphosphatate treatment, originally interpreted as an expression of breast cancer dissemination (despite no clear evidence of neoplastic bone metastasis in the imaging tests) presented by Marcocci et al., FHH may be concurrent with neoplastic disease. On the one hand, it may result in incorrect interpretation of hypercalcemia due to FHH as a symptom of neoplastic dissemination, as in the above case [32], on the other, it may contribute to the omission of a developing neoplastic disease in a patient previously diagnosed with FHH. Each time a careful analysis is necessary of the entire clinical picture and the results of the diagnostic tests, also considering the patient's family history.

Children of women with FHH may experience hypocalcaemia in the neonatal period due to inhibition of PTH secretion by the child's parathyroid glands, caused by the mother's hypercalcemia in the pre-natal period [39].

**Literature**

Acts of suicide from a Catholic faith perspective

Zachowania samobójcze z perspektywy religii katolickiej

Stanisław Pawłowski¹, Wojciech Gruszczyński²

¹ Saint George Garrison Military Parish
² Department of Clinical Psychology and Health, University of Social Sciences in Łódź

Abstract. In principle, suicide is an act that lacks general approval in society. All the presented and analyzed documents of the Catholic Church indisputably treat suicide as a serious violation of the fifth commandment of the Decalogue. Nevertheless, modern scientific research in various fields, primarily psychology, have changed or modified the perception of the act of suicide by the Catholic Church without undermining the dogmatic condemnation of the act of suicide and not always condemning the subjects, the people who commit suicide. The authors draw attention to the role and importance of so-called "spirituality" in preventive and therapeutic activities. The article is a discussion whose key focus will be the answer to the fundamental question, namely: whether the Catholic religion can be involved in programs aimed at counteracting the epidemics of suicidal behaviors in modern civilization, and if so, by what methods?

Key words: suicide, Roman Catholic doctrine, spirituality

Introduction – self-destructive behavior

Suicidal behavior, including successful suicide attempts, is a very complex phenomenon with a cross-disciplinary nature spanning sociology, psychology, psychiatry, etc. An important aspect of this problem that merits analysis is the so-called spirituality, or broadly-defined religiousness. In epidemiological terms there has been an alarming upward trend in the number of suicides and other types of self-destructive behavior.

According to a report by the World Health Organisation (2012), 800,000 people commit suicide each year, which corresponds to one suicide every forty seconds. Developing and undeveloped countries account for as much as 75 percent of all suicides, with the highest suicide rates being recorded among men aged 50-60. In European countries, suicide is the primary cause of death among people aged 15-29, and it is estimated that the number of suicide attempts is several times (up to 10-15 times) higher than the number of successful suicides. According to the statistical data from the National Police Headquarters, Poland has seen an upward trend in suicide attempts in recent years, with 7,846 known suicide attempts being made in 2012, of which 4,177 resulted in death; men and women committed 6,820 and 1,026 suicides, respectively. According to the 2013 data, 8,579 known suicide attempts were made, 6,101 of which resulted in death with men and women committing 6,820 and 1,026 suicides, respectively. According to the 2013 data, 8,579 known suicide attempts were made, 6,101 of which resulted in death with men and women committing 6,820 and 1,026 suicides, respectively.

According to a report by the World Health Organisation (2012), 800,000 people commit suicide each year, which corresponds to one suicide every forty seconds. Developing and undeveloped countries account for as much as 75 percent of all suicides, with the highest suicide rates being recorded among men aged 50-60. In European countries, suicide is the primary cause of death among people aged 15-29, and it is estimated that the number of suicide attempts is several times (up to 10-15 times) higher than the number of successful suicides. According to the statistical data from the National Police Headquarters, Poland has seen an upward trend in suicide attempts in recent years, with 7,846 known suicide attempts being made in 2012, of which 4,177 resulted in death; men and women committed 6,820 and 1,026 suicides, respectively. According to the 2013 data, 8,579 known suicide attempts were made, 6,101 of which resulted in death with men and women committing 6,820 and 1,026 suicides, respectively. According to the 2013 data, 8,579 known suicide attempts were made, 6,101 of which resulted in death with men and women committing 6,820 and 1,026 suicides, respectively.
The suicide rate in Poland in 2012 was 16.6 per 100,000 people, with the global average at 11.4. There is a relatively new notion and social phenomenon involving suicidal behavior called indirect self-destructiveness. This is defined (Gernsbocher L.M. 1985) [1] as "all potentially harmful behaviors involved in a suicidal lifestyle", with suicidal lifestyles representing an important aspect of "suicidal syndrome". Indirect self-destructive (suicidal) behaviors manifest themselves in: intentional suffering, intentional failures, helplessness, risky behaviors, impulsive behaviors, succumbing to temptation, self-handicapping, addictions, substance abuse, and broadly-defined neglect, including health neglect.

Studies conducted by Gruszczynski [2] (2002) on a population of soldiers serving in the military found that one in five soldiers exhibited self-destructive behavior in the form of a chronic syndrome (a suicidal lifestyle). An important etiological factor behind suicidal behaviors in the contemporary world is the growing prevalence of depressive disorders. It is estimated that one in ten Poles will suffer from depression, which can be fatal if untreated.

Major (recurrent) depressive disorders feature psychotic symptoms (that is to say the symptoms of a mental disease) such as delusions of guilt and punishment. A patient experiencing delusions of guilt feels responsible for all the evil in the world, even if the evil is unrelated to the patient's environment. Delusions of punishment involve a deep conviction that a serious illness (depression) is God's punishment for the patient's sins. It is important to note that depression is a disease that affects the whole body (i.e. it is not only a mental disease) and is caused by disorders in brain metabolism and the endocrine, immune and autonomic nervous systems. It includes not only volitional and emotional disorders, but also cognitive disorders (thinking), which might occasionally resemble dementia typical of Alzheimer's disease. There is a popular belief that prevention programs have little effect, since the prevalence of suicidal behaviors has been growing despite the "enormous" progress of medicine in the 20th and 21st centuries. It is important to seek new forms of psychotherapeutic measures, including measures that operate on the spiritual and human level.

Aim of the study
The authors present the views (from a historical perspective) of the Catholic Church on the issues related to suicidal behaviors as discussed in the Introduction. This article focuses on answering the fundamental question of whether the Catholic religion can and, if so, by what means become involved in programs counteracting the outbreak of suicidal behaviors in the contemporary world.

In addition to the primary aim, the article examines the existing literature to gain more insight into the attitudes (opinions) of Poles (believers and non-believers) towards the Catholic Church's doctrine regarding suicide.

The first author is a military chaplain with a record of, and experience in, ministerial service in correctional facilities, and the co-author is a former professional soldier and psychiatrist with a record of research into suicide in the military.

Suicide in the Catholic Church's records
Christian doctrine provides a comprehensive description of the behavior of human beings, including their attitudes towards their own lives. In doing so, Christianity takes a specific position on the act of suicide. The primary sources here include the Bible, the experiences of Christian communities and papal documents.

The essential document underlying Christian doctrine is the Bible. It is important to note that the Bible does not take an explicit stance with respect to suicide and people committing suicide. Although the Old Testament mentions four figures that committed suicides (Samson, Saul, Abimelech and Achitophel), the act of self-destruction itself is not openly condemned. It seems, therefore, that in its early development phases, the Church had a neutral perception of the suicide phenomenon [3].

Conversely, the Gospel shows a completely different perception of the suicide of Judas, one of the apostles, who betrayed Jesus. His act was condemned by evangelists, who would go so far as to deprive Judas of eternal redemption.

Suicidal behaviors, however, can and should be considered in the context of violating the Fifth Commandment: "Thou shalt not kill". Suicide, therefore, goes against the essence of life in Christ as described in the New Testament. Christ let God the Father decide when His Son would die, so those who believe in Christ should follow this attitude and accept the fact that God decides when and how one dies. Endurance in suffering is here an important element, constituting a declaration of faith in and commitment to God. As Saint Paul said: "No one lives for himself; we live and die for our God and our Lord, to him belongs all that lives" [4]. In light of these words, suicide seems to be an egoistic act reflecting a lack of faith and the shunning of the idea of living for God [5].

The subject of suicide was addressed as early as in ancient times and later in the works of Saint Augustine and Saint Thomas Aquinas. Both authors severely
condemned suicide, and it should be noted that the Church had previously strongly condemned all acts of suicide. Indeed, in the 6th century the Church banned donations for people who committed suicide and, later, imposed a prohibition on burying these people according to the Christian rite and on celebrating Holy Masses for the intention of those who died by suicide. Canon law maintained these prohibitions as long as until the 1980s [5].

According to Saint Augustine, a suicide is essentially a murder and as such represents a violation of the Fifth Commandment, which he extended to have the following wording: "Thou shalt not kill man; neither another nor yourself". In other words, Saint Augustine seems to suggest in his teachings that "there is no power that would entitle Christians to choose voluntary death for whatever reason" [5].

Saint Thomas Aquinas offers more extensive arguments against suicide. He defines this phenomenon based on three categories of violation: against the suicide itself, against the community and against God. First of all, every living being, by its very nature, has a love for itself, and so everything that lives strives to preserve its existence; that is to say, it has an instinct for self-preservation. Suicide is, therefore, an act against the natural law of preserving both life and love. What is more, it is a mortal sin, as it cannot be repented. Second, each human individual is a part of the larger organism of the community. People are responsible for the communities that they belong to and live in. Thus, suicide causes the entire community to suffer. Third, a man who takes his own life commits a sin against God, as human life is a gift from God, and only God, not man, may decide on life and death. Human beings may not claim any right to dispose of their lives [6].

Nowadays, the Church allows for Christian burials of suicides, assuming that the deceased may have repented of his act before death. The Church may, however, make an exception from this principle when the person committing suicide lacks penance and their contempt for life is unquestionable, or where a Christian burial might cause public outrage [5].

The Congregation for the Doctrine of the Faith is of the position that suicide is one of the gravest moral offences against both civilization and God [7]. This position has been confirmed in the context of the discussions on euthanasia, when the Church retained its stance that any form of killing (suicide included) is unacceptable [5]. The Catechism of the Catholic Church has a similar perception of the issue of suicide. In Part Three ("Life in Christ"), Chapter Two ("The Ten Commandments"), the Catechism explains the essence of suicide by invoking the Fifth Commandment: "Everyone is responsible for his life before God, who has given it to him. It is God who remains the sovereign Master of life. We are obliged to accept life gratefully and preserve it for his honor and the salvation of our souls. We are stewards, not owners, of the life God has entrusted to us. It is not ours to dispose of" [8].

Reasserting the traditional attitude towards the act of suicide in Christian religion, the Catechism argues that suicide contradicts the natural inclination of the human being to preserve and perpetuate his life. It is gravely contrary to the just love of self. It likewise offends love of neighbor because it unjustly breaks the ties of solidarity with family, nation, and other human societies to which we continue to have obligations, and is contrary to love for the living God [8]. If suicide is committed with the intention of setting an example, it also takes on the gravity of scandal [8]. At the same time, the Catechism allows for certain extraordinary circumstances which can diminish the responsibility of the one committing suicide. They include: "grave psychological disturbances, anguish, or grave fear of hardship, suffering, or torture" [8]. As far as those who die as a result of suicide are concerned, the Catechism takes a novel approach, assuming the possibility that God might forgive the one committing suicide. Thus, one should pray for his salvation, as "we should not despair of the eternal salvation of persons who have taken their own lives. By ways known to him alone, God can provide the opportunity for salutary repentance" [8].

The subject of human life is a key theme in all documents by Pope Saint John Paul II. The importance of human life in the teachings of the Church is reflected in the fact alone that Pope's first encyclical "Redemptor hominis" was devoted to the human being [5]. It is, however, another papal encyclical, entitled "Evangelium vitae", that is significant for the discussion of suicide. In it the Pope addresses the subject of love for, faith in and good of the human individual. All these values are inextricably linked to the inviolability of life [5]. While according to the papal letters man is the basic determinant of the path of Church, "Evangelium vitae" explicitly states that the man must be alive [9]. The Pope observes that it is unacceptable for the teachings of the Church to be contrary to the Fifth Commandment about the protection of life. John Paul II reminds us that life, and its preservation and protection, is needed by both the individual and the entire community, and "every threat to human dignity and life must necessarily be felt in the Church's very heart". Also, the Pope reiterates the position adopted by the Church at the Second Vatican Council, which explicitly and relentlessly condemned voluntary suicide as "being opposed to life itself" [9]. Suicide is, therefore, like murder, an absolutely unacceptable act. An act of suicide is a disgraceful act for one more reason – it is an attempt by the individual to arrogate to him or herself God's right to dispose of life.
Life, as a priceless gift from God, must be fully embraced by the human person. It is unacceptable to put an end to this life and willingly interfere with God’s plans, as “man is not the absolute master and final judge, but rather – and this is where his incomparable greatness lies – he is the “minister of God’s plan” [9]. Notably, however, in subscribing to this modern approach of the Church, the Pope allows for the presence of certain psychological, cultural or social factors that affect the judgement of the one committing suicide and his intentionality and awareness while committing suicide. Objectively, however, suicide remains an ultimately immoral act, as it is contrary to the natural right of the human being to preserve and protect his own life, and also because it constitutes the shunning of the love of neighbor, the severance of social bonds, and the negation of the absolute power of God over life and death [9].

In each of the five major religions of the world, life is of paramount importance. Judaism unconditionally condemns the act of self-destruction, perceiving life as the ultimate value. Jews believe that since God is the source of all creation, it is only He who may take one’s life. Muslims believe that life is sacred and belongs only to Allah, and it is not for man to decide who should die. The fourth surah of the Koran directly forbids committing suicide: “And do not kill yourselves. Surely, Allah is Most merciful to you!” In Hinduism, like in other religions around the world, life is equally priceless. This religion sees those who commit suicide as ones who deprive themselves of opportunities for spiritual development and will wander the world “until the time one would have otherwise died”, after which they are reborn to a world that is much worse than the one they were trying to escape. Buddhism by definition condemns any evil against any living being, including the killing of one’s own self, and also preaches the need for keeping one’s body and mind in good condition. Suicidal behaviors, therefore, go against these two rules of Buddhism. The one who committed suicide will face the negative consequences of his act after reincarnation [9]. It should be noted here that the reported cases of suicide by self-incineration among Buddhist monks should be considered a separate category, as they are a form of political protest. Suicide can be acceptable, then, in extraordinary cases. In summary, suicide is considered to be one of the gravest violations in both the Christian tradition and other monotheistic religions that regard life as a sanctity.

Before psychological and social sciences came into existence, it was a popular belief that suicides bear the absolute responsibility for their acts. Consequently, they were considered to be ultimately guilty of taking their own lives. With the progress of psychology and social science, people now have a better understanding of the phenomenon of suicide. This development has prompted the Catholic Church to revise its judgement of people who commit suicide. In contrast to the teachings of the Church, psychologists and sociologists approach suicidal behavior differently by viewing it in isolation from any moral aspects as a purely scientific phenomenon.

The psychology of suicide is generally bound by the limitations inherent to the group it aims to study. Indeed, psychologists can examine only those who unsuccessfully attempted suicide and study suicide letters. Initially, suicide was understood as a mental disease, and thus the factors of free will and responsibility were ruled out. Nowadays, it is assumed that one in five people are not of sound mind when committing suicide, which partly, or fully, releases them from responsibility. It is important here to explain the term of "unsound mind", which is a legal term (used in the Penal Code) meaning the opposite of soundness of mind (sanity). A person who is of unsound mind "does not commit a crime if, as a result of mental retardation (intellectual disability), mental disease or other mental disturbance, he/she is unable to appreciate the quality and nature of his/her acts and to control them at the time these acts are committed". By analogy, it can be claimed that suicide in the Catholic Church’s doctrine is a type of "crime" (a disgraceful act, "a mortal sin") against the Fifth Commandment.

Similarly, Fr. Anselm Grün argues that “when someone around us commits suicide, we must never judge him. Such a person is often suffering from depression, and as such is ultimately not free” [6].

**Contemporary perception of acts of suicide by the Catholic Church**

Progress in psychology has changed the way the Catholic Church perceives suicide. Although acts of suicide continue to be perceived by ethicists and theologians as the ultimate evil, it is assumed that those who resort to this drastic measure are not acting reasonably. No one is able to grasp the pain that pushes a man to take his own life. By extension, while suicide is always objectively an evil act, no one has the right to judge the suicide, as it is impossible to comprehend the mental pain and reasons that drive a person to such an act. This encapsulates the Church’s contemporary understanding of the phenomenon of suicide. Acts of suicide are considered to be acts against the Fifth Commandment, but the people committing suicide are not condemned and automatically sentenced to eternal damnation. In other words, it is assumed that God is able to fully judge the degree to which the person taking his own life is responsible [5]. Both psychologists and
Act of suicide from a Catholic faith perspective

Ethicists face the challenge of determining the degree of awareness, and hence the guilt, of individuals committing suicides. One must not, however, refrain from judging the morality and responsibility of the subject for an act of suicide, as clearly some suicides are committed voluntarily and with full awareness. Again, there is also no denying that, more often than not, suicide is not a matter of choice but rather a consequence of suffering from which there is no viable relief. People kill themselves when they do not see a way out of their predicament and feel overwhelmed beyond their ability to endure. Once the mental pain is overcome, however, the would-be suicide will always choose to live. Spirituality plays an important role here, so psychologists might sometimes encourage patients to search for a spiritual path in order to prevent them from committing suicide. Spirituality helps one to cope with despair by forming a source of consolation. As such, it becomes an alternative to self-induced death.

The extensive literature on spirituality covers three fields: theology, philosophy and psychology. The psychological approach accentuates the subjective nature of spirituality (spiritual experience). One type of spiritual experience is mysticism, which allows for the possibility of direct contact between the believer and God, the human soul and the absolute, leading to the mystical unity with the deity. Psychology considers spirituality to have a regulatory function with respect to human functioning in terms of activity and internal experience. The specific activity that spirituality entails is transcendental, going beyond the immediately experienced real “self” (ego).

The issue of spirituality has been underestimated and marginalized by Polish psychiatric literature so far. There is not enough space to provide a more in-depth explanation of the notion of spirituality in the context of the human psyche. In essence, the human psyche comprises three components: the intellect (reason – IQ), the feelings (emotions) and the will (to act). The latter two – feelings and will – constitute the character which is described as emotional intelligence (EQ). The psychological studies conducted since the late 20th century have corroborated that EQ plays the key role (80%) in broadly defined success in life [10]. These components have their own biological (anatomical, physiological and biochemical) backgrounds, and so changes to, or disorders of, this background impact on the mental and somatic (psychosomatic) condition.

Spirituality is associated with the agency of supernatural powers (such as God), or with a special dimension of the psyche, or a combination of the two. In the so-called Western European countries and the USA, spirituality is a prioritized aspect in contemporary treatments of mental health issues (known as psychosomatic medicine).

This was reflected in the guiding theme of the 168th American Psychological Association's convention held between 16 and 20 May 2015 in Toronto. The theme was: “Integrating Body and Mind, Heart and Soul”. Debaters stressed the important role of psychiatrists in discussing the biological background of mental diseases outside of the psychiatric community. Also, the need was highlighted to regard psychiatry as a field concerned with "neuropsychiatric" diseases without making psychiatry "heartless and soulless". It is important to note that the annual APA conventions are major scientific events of global proportions and international nature, with turnouts ranging from 14,000 to 15,000 people [11].

Attitude towards religion as a determinant of views on suicide

This subchapter is based on Chapter 81 of Brunon Holyst's monograph "Suicidology" [12]. The blurb features the following sentence: "The range and constellation of the problems this book analyses make it a unique piece of European suicidological literature". In the book, the author presents the results of questionnaire surveys covering a population of 2,795 Poles. The respondents were asked to define their attitudes towards religion based on a four-point scale: (1) devout believer; (2) believer; (3) undecided; (4) non-believers. The relationship between the proclaimed religious beliefs and the views on whether acts of suicide are morally acceptable appears to be clear, with substantial statistical differences. Holyst points to two fundamental differences: (1) between believers and the undecided, with the latter being three times more likely than the former to consider suicide as morally acceptable; (2) between the undecided and non-believers, with the latter being almost two times more likely than the former to consider suicide as morally acceptable. Still, even among proclaimed non-believers, the majority dismissed suicide as morally unacceptable. However, whereas among devout believers and believers only one in twenty, or even less, respondents did not condemn suicide as an immoral act, the corresponding figure among the undecided respondents is approximately one in seven respondents, and for non-believers one in three to four respondents.

The respondents were also asked about their views on the mental condition of people committing suicide. Three distinct groups of views can be identified based on the answers: (1) devout believers were the most likely to consider suicides as being mentally disturbed or deficient; (2) believers formed the intermediate group; (3) the undecided and non-believers were the least likely
to consider suicide attempts as signs of mental disorders. A study of how the proclaimed religious beliefs influenced the respondents' views on what, if at all, could justify suicide produced some very interesting results. Of ten possible reasons justifying suicide, only one proved to be statistically unrelated to religious beliefs. This reason was "losing the meaning of life". The authors of this work (Pawlowski, Gruszczynski) would like to note here that the issues involving the so-called meaning of life are embedded in the previously-mentioned spirituality.

Some profoundly distinct results were obtained regarding the respondents' view that there were no circumstances justifying suicide. A clear line of distinction is drawn here between devout believers and believers, on the one hand, and the undecided and non-believers on the other. Compared to other respondents, devout believers were far more likely to express the view that there were no circumstances that could justify suicide.

To summarize the views of Polish respondents on suicide presented in the context of their attitudes towards religion, one should conclude that the large majority of devout believers and believers fully subscribe to the doctrine of the Catholic Church, and even tend to be more orthodox by arguing that there are no circumstances justifying suicide. It should also be noted that in the population of the undecided and non-believers, a substantial proportion of the respondents exhibited beliefs are largely in line with the doctrine of the Catholic Church.

Suicide in correctional facilities (based on author's own ministerial experience)

Suicide committed by convicts forms not only a traumatic experience to those who work with them, but also evidence that resocialization efforts have been ineffective. Prison suicides also entail legal consequences, including for prison guards, whose task it is to make sure that the prisoners remain safe [13]. Suicidal behaviors in correctional facilities can be caused by three types of factors: clinical (personality disorders), social (isolation and lack of support) and personal (cognitive components, e.g. attributions, cognitive rigidity). Suicide is often caused by a severe mental crisis, when the individual is unable to find a solution to a specific, difficult problem. Mental crises are particularly dangerous in that they can suddenly and unexpectedly escalate into suicidal crises [13]. Further risk factors related to self-destructive behavior include depression, addictions (e.g. alcoholism), anti-social behavior, personality disorders, chronic suicidal thoughts, a record of suicide attempts, prison isolation and the related behavioral disorders developed as a result of adaptation to the conditions in correctional facilities. Prison isolation is a particularly traumatic experience, as it involves additional mental struggles, such as "the inmates' fear of the unknown, mistrust towards prison staff, isolation from close ones, a sense of disempowerment and a sense of shame induced by the stigmatization and dehumanizing conditions in which the sentence is served" [13]. Prison conditions can additionally "impair the affect-regulation mechanism by shifting emphasis from a relatively mature affect to one that is more labile and impulsive, and lead to social withdrawal, self-harm tendencies, including suicidal and other tendencies" [13].

To prevent suicides in correctional facilities, the World Health Organisation, in conjunction with local actors (such as the Polish Association of Suicidology), have developed suicide prevention standards for prisons [14]. These standards include recommendations to develop suicide profiles, conduct intake screening and post-intake observation, place inmates into shared cells and identify the factors that precipitated, and reconstruct, the events that led to the suicide attempt [13]. As already mentioned, prison suicides are acts that entail adverse social and psychological consequences. Despite the isolation inherent to correctional facilities, inmates and prison staff develop certain relations. These are often personal relations, based on conversation, understanding or empathy. By committing suicide, the inmate "suddenly breaks this relation, causing its ultimate failure" [13]. It is believed that religious faith, including in particular the Christian faith, can prevent suicide. This might stem from the fact that the Church considers suicide to be morally evil, representing one of the gravest violations against God and a fellow human being. Studies on prison suicides and their underlying causes have not provided clear results; the relationships between suicide and Christian faith can be of both a protective and destructive nature.

In my time as a prison minister, I dealt with eighteen inmates who attempted suicide while serving their sentences. Fourteen of them claimed to be members of the Catholic Church. When talking with one of the would-be suicides, I learnt that the Christian faith had saved him from death. The man had planned his suicide and proceeded to carry out this plan. At the last moment, however, he called the guards. He later said that the thing that stopped him from self-destructing was the belief that "if I kill myself, I will not go to heaven".

In some cases, though, the belief that suicide is a sin is not enough. Below I describe the case of another prisoner, who attempted suicide after preventing his fellow inmate from taking his life. The man claimed that he had saved his fellow inmate to give himself a pretext...
for taking his own life. A crisis of faith was also the immediate cause of attempting suicide for another prisoner, who had been abused by a fellow inmate due to his openly and devoutly Christian demeanor. The would-be suicide confessed that he had put his trust in God, and that the Bible he had with him would protect him from any harm. However, the man was abused again the next day.

Countering suicide is one of the goals of ministerial care, especially for prison chaplains. Inmates across correctional facilities in Poland may receive ministerial care, as they have a vested right to practice religion. The distinct nature of the prison community and the specific needs of prisoners led to the development of prison ministry within the Church, which "molds the religious lives of people deprived of liberty and other relations within the community of prisoners, and in so doing, perpetuate objectively proven values without glorifying evil, violence or anti-social behaviors" [15]. Chaplains seem to play a particularly important role as educators and therapists providing inmates with spiritual and psychological support. Ministerial care aims to make prisoners realize that their deeds were evil while providing them with a compass to guide them back into society. In the context of the Catholic religion, this compass always points a way to life, never to death. The function of the prison minister as a role model and dismantler of prison subculture can also bring in a positive atmosphere to correctional facilities, helping to prevent suicide resulting from victimization from fellow inmates.

Discussion

As already mentioned, the Catholic Church has revised and moderated its perception of suicide in response to scientific progress. Suicide continues to be considered as the ultimate evil by ethicists and theologians. Nevertheless, it is assumed that those who resort to such a drastic measure are not acting "reasonably" and therefore may not be condemned and automatically sentenced to eternal damnation. According to Reroń (1995), "God is able to fully judge the degree to which the person taking his own life is responsible". The term "reason" used here is imprecise and incomplete, as from the perspective of the human psyche, it means "intellect" (IQ); that is to say, it refers to the cognitive domain. Psychological studies conducted since the late 20th century have proved that human functioning relies primarily not on "reason", but on "emotional intelligence" (EQ), which involves emotions and volition (feelings and will).

From a psychiatric point of view, if we assume that suicide is a peculiar type of "a declaration of will", then both the very act and the person committing suicide should be judged in an individual manner – a manner which is often a far cry from common moral judgement. It should be remembered that according to the commonly accepted standards of issuing forensic psychiatric opinions in civil-law cases, a declaration of will is deemed to be valid provided that the person making the declaration was aware of his/her decision, made it voluntarily and was able to act on it directly by, for instance, committing suicide. The civil code does not provide for any limitations on the capacity to make declarations of will, so a declaration of will is either valid or invalid. Forensic psychiatry assumes that some mental disorders (psychopathologies) preclude people from making a conscious or voluntary decision and declaration of will. These disorders include profound dementia, regardless of the causes, dementia with psychotic features, disorders of consciousness and organic psychoses without dementia. It is therefore reasonable to claim that suicide committed by someone suffering from one of these disorders does not meet the criteria of an act of suicide and as such should not be subject to moral judgement. It should be considered irrelevant to the overall judgement of the ethical and moral, including religious (spiritual), attitude of the suicide.

For instance, a patient with alcoholic hallucinosis might hear the distinct and seemingly real voices of his victimizers threatening him with death for his sins involving alcohol abuse and the related social consequences. Suddenly, the patient might distinctly hear the steps of the approaching executioners. Being in a closed room – for instance, in a hospital ward – instead of escaping through the door, such a patient "runs" for his life by jumping out of the window. Does this qualify as an act of suicide? After all, the patient acted in a subjectively reasonable manner that was adequate to the psychotic (disease-related) experiences he was having. From a philosophical perspective, it might be speculated that the patient was to some degree responsible for his alcoholism (or any other addiction), but it is often the case that acts of suicide are committed in so-called primary (endogenous) psychotic conditions (schizophrenia, depression), whose underlying causes have not been determined yet despite the remarkable progress in neuropsychiatry. The Catholic Church's doctrine on the moral judgement of suicide (both the person committing suicide and the act) has been evolving towards embracing more fully the achievements of various fields of science, including primarily psychology and psychiatry. It should be remembered, however, that until the late 1980s, the Church officially adhered to the severe restrictions on suicide victims introduced in church law in the 6th century. Nowadays,
while people committing suicide are not downright condemned, it is still believed that "only God can judge the responsibility of the suicide". It seems that science is now, in some cases, able to judge (with "God's help") with greater confidence, if not certainty, whether an act of suicide was committed as a "conscious and voluntary decision or act of will".

At the Last Judgement, in His mercy, God will judge fairly both the act and the subject (the suicide). Before this, however, it is very important to make an "earthly" ethical and moral judgement as psychological and spiritual support for the surviving family and close ones of the suicide victim.

Conclusions

- The extensive scientific achievements of Catholic spiritual theology could be explored and put into practice to contribute to preventing suicidal behaviors in Poland.
- The notion of spirituality is understood as both the practice of spiritual life (in the subjective sense) and the systematic reflection on this spiritual life (in the objective sense).
- In the late 20th century, John Paul II inspired the Catholic Church to revise its doctrine regarding the judgement of suicide. Consequently, the Church began to condemn only the act itself as being contrary to the Fifth Commandment, leaving the judgement of the moral responsibility of the suicide to God as the Giver of Life.
- The authors of this article believe that the current state of scientific knowledge allows us to make – with great confidence, if not certainty – judgements on the responsibility of the suicide at the moment of committing the act of suicide (just like the Code of Canon Law provides for the possibility of declaring marriage as void).
- The large majority of surveyed Poles who are devout believers or believers, as well as a substantial portion of the undecided and non-believers, subscribe to the Catholic Church's doctrine regarding acts of suicide.

Literature

2. 2 Gruszczyński B. Przejawy i uwarunkowania autodestruktynyoci pośredniej u żołnierzy służby czynnej [The manifestations and conditions of indirect self-destructiveness in soldiers in active duty]. Doctoral thesis. Wojskowa Akademia Medyczna, Łódź 2002
7. The Second Vatican Council Lumen gentium, the Dogmatic Constitution on the Church. Pallotinum, Poznań 2005: Gaudium et spes, no. 27
8. The Catechism of the Catholic Church Pallotinum, Poznań 1994: 2280-2283
The problem of eye disease in the former Polish Army

Problematyka chorób oczu w dawnym Wojsku Polskim

Krzysztof Kopociński, Zbigniew Kopociński, Czesław Jeśman
Department of the History of Medicine, Pharmacy and Military Medicine of the Medical University in Łódź; head: Prof. Czesław Jeśman MD, PhD

Abstract. The beginnings of modern ophthalmology began at the end of the 18th century. At that time, many outstanding doctors made exceptional inventions, such as Herman Helmholtz who invented an ophthalmoscope, Herman Snellen the Snellen chart, and Alexei Maklakov and Hjalmar Schiötz a tonometer. Trachoma was the main problem of Polish military physicians in the 18th and 19th centuries, especially after 1803 when the French soldiers of Napoleon Bonaparte brought trachoma from Egypt and Syria. Trachoma, also known as Egyptian ophthalmia, is an infectious disease caused by Chlamydia trachomatis. Nowadays, about 80 million people have an active infection (Africa, Asia, Central and South America). In Poland, the trachoma epidemic was overcome only after World War II. It was a great victory for Polish ophthalmologists.

Keywords: trachoma, ophthalmology, military hospital, military physician


Słowa kluczowe: jaglica, okulistyka, szpital wojskowy, lekarz wojskowy

The beginnings of modern ophthalmology

Ophthalmology is a relatively young medical discipline, which was only separated from surgery as late as in the 18th century. Before that, eye diseases had been treated by regular doctors, surgeons, barber surgeons and, not infrequently, quacks and charlatans. The first extraction of a cataract, i.e. a cloudy lens, was conducted by a French physician, Jacques Daviel, in 1745. Up to that point, the treatment involved pushing the lens against the vitreous body. His compatriot, Pierre Pamard, in 1759 modified the surgical method by placing the patient in a supine position, which greatly facilitated the physician’s work. The very term “ophthalmology”, which describes a separate scientific field dealing with eye diseases, was introduced in 1800 by Karl Himly, a surgeon (and later an ophthalmologist). A few years later, in 1804, the first eye hospital was established in London, and the second institution of this type opened in Saint Petersburg in 1806. The discoveries of new diagnostic apparatuses facilitated the further development of ophthalmology. A German professor from Potsdam, Hermann Helmholtz, played a key role in its development when in 1851 he invented the ophthalmoscope, which allowed the evaluation of the fundus of the eye and, in a modified form, is still widely used today. Equally important contributions were made by the professors Frans Cornelis Donders and Herman Snellen. In 1864, the former published his great work entitled “On the anomalies of accommodation and refraction of the eye, with a preliminary essay on physiological dioptrics”, in which he described all eye defects and the importance of using glasses for correction. His student, Herman Snellen, creatively developed the thinking of his professor and introduced optotypes to study visual acuity (Snellen chart). In 1885, a Russian professor, Alexei Maklakov, invented the tonometer for measuring intraocular pressure (a rather peculiar device, which is still used to this day by Russian doctors). A different type of this device was created in 1905 by a Norwegian professor, Hjalmar Schiötz, which is still widely used. All these inventions, when paired with...
the effort of wise and creative surgeons, made the development of modern ophthalmology possible.

In Poland, as elsewhere in Europe at the time, eye diseases were initially treated by physicians as well as by barbers and charlatans. As early as in the 13th century, the famous Witelo (Witelo, Vitello), a friar and philosopher, worked here for some time. He wrote “Peri-Optikes”, a work on the basics of eye anatomy according to the knowledge available at that time, the rules of optics and the theory of vision. In the 16th century, in the royal city of Lviv, which was then the pearl of the Polish Crown, Jew Elijah practiced the profession and performed cataract removal surgeries. In 1568, a surgeon by the name of Czeszer treated Anna Jagiellon’s acute pain and swelling of the eye. Grzegorz Buzau performed cataract removal surgeries in 17th-century Kraków and there are accounts of procedures performed by one Jakób Stebler.

Unfortunately, these were only isolated cases of relatively modern thinking, as that period was largely dominated by herbalism and rather inaccurate theories regarding eye diseases. The latter was exemplified in the ideas contained in the publication “Gadki o skłonności członków człowieczych” [Essays on the susceptibilities of human limbs] from 1535 by Andrzej Glaber of Kobylin, who formulated the bizarre theory that bald people were not prone to blindness, “because they have enough moisture in their heads...”. In his famous “Herbarium” published in 1613, Professor Szymon Syreniusz listed the medicines to be used for the treatment of eye diseases like leucoma, floaters, and low visual acuity. Unfortunately, herbalism could not offer effective treatment for the said disorders, but the existence of such recipes provides some insight into the main problems that ophthalmology faced at that time. This is the starting point from which Polish physicians began at the turn of the 19th century, a time seen as the beginning of modern ophthalmology [1, 2].

Eye diseases in soldiers serving in the former Polish Army

Paradoxically, the Napoleonic Wars were a time of great significance in the development of the diagnostics and treatment of eye diseases. In 1803 French troops stationed in Egypt and Syria brought Egyptian ophthalmia (ophthalmia aegyptica or ophthamo-blinnorhoea epidemic) or trachoma, back with them to Europe. It is an extremely dangerous eye disease caused by Chlamydia trachomatis, being transmitted by a common species of fly. It was and remains a major cause of blindness around the world. The first ones to struggle with the disease were the medics and surgeons of the French troops stationed in Egypt and Syria.

A key role in its treatment was played by one of the most prominent military surgeons of that time, Dominique Larrey (1766-1842), who proved the contagious nature of the disease and invented a special device for transporting the wounded on camels. However, he was primarily an excellent surgeon, who became famous in his field. During the Russian campaign, and the dramatic struggle of Berezina in November 1812, he was always by the side of the French Emperor. Napoleon himself, moved by the heroism of the Poles who provided cover for the retreat of the Great Army, personally commanded that his medic operate on General Józef Zajączek, who was badly wounded in the leg. The words he addressed to the aide-de-camp of the wounded general, Major Józef Krasinski, became legendary: "C'est bien, faites l'apporter ici, chez moi l'entendez vous, chez moi ici" ("It's fine, have him brought here, to me. Do you hear me? To me, here."). The excellent surgeon saved the life of the Polish soldier, although he had to amputate his bullet-shattered leg; still, it was a major success for the battle-scarred medic.

Another military surgeon who made a contribution to the fledgling field of ophthalmology was Leopold Lafontaine (1756-1812), the court physician of King Stanislaw August Poniatowski, and, from 1807, the first surgeon of the Polish Army. In 1801-1802, he prepared "Hygiene rules related to the eyes", which was a quick response to the news of the epidemic raging in the French army in Egypt and Syria.

Egyptian ophthalmia, or trachoma, spread to a number of different European countries, including Poland, during the Napoleonic wars, with infected soldiers travelling throughout almost the whole of Europe. This had a major effect on the health of the individual nations, and in 1818 alone there were about 5 thousand blind people in England.

All this, as it were, forced the development of ophthalmology as a separate discipline of medicine. Independent eye hospitals also began appearing, with the first established in 1804 in London. In the Kingdom of Poland, the first such establishment was the Ophthalmic Institute, founded in 1823 by Prince Edward Lubomirski and organized three years later in Warsaw by Johann Hullverding [1-3].

The Polish Army and its medical services came into contact with the army of the French Emperor during the Napoleonic Wars, and suffered problems similar to those of its allies. The spreading epidemic of Egyptian ophthalmia gradually made its way into Polish military units, with both low-ranking soldiers and senior officers contracting the disease.
During the Russian campaign this was the cause of the commander of the 8th Uhlan Regiment, Colonel Dominik Radziwiłł (1786-1813), being unable to command his unit. However, literally at the last possible moment, he managed to join his subordinates as they entered the Battle of Borodino (5-7 September 1812). Such cases were certainly much more numerous than is recorded.

After Napoleon’s defeat, in early 1816, the epidemic spread among the soldiers of the Imperial Guard Infantry Battalion. Their medic, chevalier of the French Legion of Honour, Dr. Karol Konstanty Grygorowicz (1784-1855), was initially of the opinion that the disease was caused by humidity and cold in the barracks, as the furnaces were spilling out smoke, so their use was discontinued. More cases of the disease occurred in July of the following year, though, and this time the high temperatures and the dust were to blame. At the request of the physician, midday drills were stopped, and training was to be followed by a rest period in a cold place before the soldiers returned to the barracks. After training, the soldiers were ordered to rinse their eyes with cold water. Further eye disease epidemics occurred in the following years in various units of the Polish Army.

The situation became so serious that on 25 April 1820 an order was issued to all regimental doctors to inspect the eyes of all soldiers during each evening assembly, and if they found even the slightest signs of inflammation to apply a red mercury oxide ointment. There were three recipes for preparing this ointment:

- According to J. Radke: hydrarg. oxydatum rubrum cum butyro,
- According to L. Lafontaine: hydrarg. oxydatum rubrum cum butyro cum camphora,
- According to F. Swencki: hydrarg. oxydatum rubrum cum butyro cum camphora cum acet plumbi.
By the end of 1821 they had managed to contain the epidemic, but in the following year more cases of Egyptian ophthalmia (trachoma) were recorded in several regiments, including in the Cadet Corps in Kalisz. The Corps introduced a rule that anyone who was cured should be isolated from the other cadets and instructors of the school for a specific period (separate quarters were rented for them), which proved to be a very effective method of preventing the epidemic from spreading. All attempts to fully eradicate Egyptian ophthalmia were in vain in those times, and even during the November Uprising in 1831 the disease struck again in Modlin. Patients were isolated in separate linen tents outside of the hospital.

Trachoma remained a serious problem for decades, even among the soldiers of the Second Polish Republic, who were grouped into special trachoma companies composed only of soldiers suffering from this disease. After the Second World War it was still very dangerous, which is why the military medical services sent its medics to special anti-trachoma courses organized by Prof. Marian Wilczek in Witkowice. Not until the late 1950s was this dangerous disease finally conquered in Poland and the current generation of Polish ophthalmologists does not deal with such patients, which is one of the greatest successes of several generations of eye disease specialists. This demonstrates that the health effects of the Napoleonic Wars continued to be felt by Polish society for nearly another 150 years.

In the times of the Kingdom of Poland the Polish Army and its medical services made every effort to make use of the latest achievements of medicine, including those in ophthalmology, within the resources available. It is worth emphasizing that as early as in 1822 the chief medic of the Grenadier Battalion of the Imperial Guard, Maximilian Deiffinger, organized a field ophthalmic infirmary in the camp. It provided isolated quarters for soldiers suffering from Egyptian ophthalmia (trachoma), who were to be sent to the Main Hospital in Warsaw should their ailments intensify. In 1827, a separate ophthalmology ward was planned in Praga or Solec that would be subordinate to the Ujazdowski Hospital, but the idea did not come to life. The fact that military medics organized a field ophthalmology hospital even before the Ophthalmic Institute in Warsaw was established is definitely praiseworthy and proves the extent of their knowledge and enlightenment [3-7].

Serious eye diseases spreading among the public also affected the conscription methods. Until the 19th century, there were no specific regulations regarding the qualification of conscripts suffering from eye diseases. People suffering from blindness or very poor visual acuity were probably not enlisted, although the decisions were dictated by common sense, as there were no applicable regulations. Some legal regulations concerning eye diseases were contained in the “Collection of Laws, Acts and Edicts Regarding Recruitment in the Russian Empire” published in 1803, with its 1807 second edition featuring a document entitled “A Manual to Guide Physicians at Recruitment Stations Prepared by the Chief Inspector of the Land Forces Medical Division, Leib-Chirurg Jakub Willie Following His Imperial Majesty’s Highest Command”. These Russian regulations were translated into Polish and made binding on the territory of the Kingdom of Poland during the so-called Congress of Poland (which was established after Napoleon’s defeat, at the peace congress in Vienna in 1815). This divided diseases into three groups:

- diseases rendering the recruit unable to perform military service,
- false or pretended diseases,
- occult diseases.

The first group was further divided into:

- diseases of the mind,
- internal bodily diseases,
- external bodily diseases, systemic or local.

Referring to the observations included in those regulations and relating to the examination of the eye, it can be seen that even when a patient was suspected of a mental disease, careful attention was to be paid to the condition of the eyes. According to the author of that manual, “idiocy or dullness of the mind” was connected with the presence of a “wild look” in the patient, and “mania, or mindlessness” was expressed by a “sad gaze and dark eyes”. Arguably, those guidelines were not very useful or specific, but they provided a certain basis for consideration on the part of the physicians who were examining recruits. The group of external diseases featured the following (modern names in parentheses): “bright-light blindness” (amaurosis), “darkening of the crystal lens” (cataract), “fused pupil” (occlusion of the pupil – oclusio pupillae), “watery swelling of the eye” (glaucoma), “chronic inflammation and pus discharge from the eye” (chronic conjunctivitis, conjunctivitis chronica), “short sight” (myopia), “incurable spots on the transparent corneal membrane” (corneal spots – maculae corneae, leucoma), “squinting” (strabismus), and “eyelids adhering to one another or to the connective membrane” (ankyloblepharon, adhesion of the palpebral conjunctiva of the eyelid to the bulbar conjunctiva – symblepharon). Dacryorrhea can be found in the same list of diseases, but in a separate group of facial diseases.

It should be stressed that listing the specific disease entities (although referred to in somewhat archaic terms) demonstrates the relatively extensive knowledge of the physicians of that time in the fields of ophthalmology and
correct diagnostics, taking into account the state of development of medicine. Interestingly, the group of false, or pretended, diseases included blindness. This was due to the large number of people who pretended to be blind in order to avoid military service.

Conscription was performed by district (lower) and voivodeship (higher) conscription commissions, which included a physician responsible for examining all recruits, which made malingering very difficult. It goes without saying that the level of reliability of the opinion depended on the level of education and the skills of the particular physician. The lists of recruits from the first half of the 19th century include descriptions of diseases due to which recruits were considered unfit for service; in ophthalmology those included “feigns blindness”, “for a spot in the eye”, “for poor sight”, “proven to have ruined his eyes himself”, “a trickle from the eye”, and “dark-eyed”. It is clear that some physicians could not correctly define a given ailment using medical terms, hence the colloquial terms.

The Medical Council, which supervised the work of the recruiting commissions, often requested that the physicians perform the examinations more carefully and use scientific terms in preparing the documents. Well-educated doctors had already learned such terms as cataract, amaurosis, myopia, glaucoma, etc. What is interesting is that with blind people the recruiting commissions were allowed to make the decision on releasing the patient from service exclusively on the testimony of reliable witnesses [8-10].

In 1837, the Medical Council received an order to translate the Russian “Manual for Physicians in Recruiting Commissions” from 1831 and to adapt it to the situation in the Kingdom of Poland. It was slightly outdated, so the physicians supplemented it with an additional list of diseases and a special manual for purulent inflammation (which was another name for Egyptian ophthalmia, or trachoma). The original Russian manual listed the following eye diseases as reasons for exemption from military service (currently used names in parentheses): “transformation of the eye called staphyloma” (staphyloma), “cataract”, “albugo” (leucoma), “watery swelling of the eye” (glaucoma), “chronic inflammation and pus discharge from the eye” (chronic conjunctivitis), “eyelid turned outward” (ectropion), “eyelid folded inward” (entropion), “hare’s eye” (lagophthalmos), “eyelashes growing back” (defective eyelash growth, trichiasis), “eyelids adhering” (ankyloblepharon), “fused pupil” (occlusion of the pupil – occlusio pupillae), and “bright-light blindness” (amaurosis). The Polish translation additionally included the following eye diseases: “split eyelids” (eyelid coloboma), “drooping eyelids” (ptosis), “tumor and eyelid cancer” (tumors and carcinoma palpebrae), “strained lacrimal points”, “tumorous and cancerous swelling of the lacrimal body”, “tumor, cancer and follicular lesion of the lacrimal body”, “incurable excrescence on the corneal membrane known as hyperkeratosis”, “congenital or overall distraction-induced enlargement of the eye volume” (bupthalmos), “considerable shrinking and devastation of the eyeball” (shrinkage of the eyeball, atrophia bulbi oculi), “eye cancer” (carcinoma oculi), “eyeball falling out of the socket” (avulsion of the eyeball - avulsio bulbi), “high squinting” (strabismus), and “various incurable swellings in the eye socket”. A comparison between the Polish and Russian manuals demonstrates that the knowledge of ophthalmology by physicians of the Kingdom of Poland Medical Council was slightly more extensive than among their Russian colleagues. The publication of a dedicated manual on blinding trachoma clearly shows that the physicians of the Kingdom of Poland did not treat this disease lightly and learned to correctly diagnose it and prevent the spread of the epidemic. The manual prohibited the enlisting of people suffering from this disease and also people who had had the disease and had been left with permanent complications (“the granulation of the meaty excrescence or high roughness of the connective membrane”). The initial progression level of the disease was not sufficient grounds for releasing from service, but such recruits were directed to a hospital for treatment as soon as they had been enlisted.

Conclusions

The turn of the 19th century saw the rapid development of ophthalmology as a separate medical discipline. The period of the Napoleonic Wars and the fact that trachoma was carried by French troops to the European continent and then spread to all European countries was a significant factor in this. This disease was the most serious concern among military surgeons of that time. Initially, the French played the most important role in fighting this disease, establishing clear rules of conduct with such patients which were adopted in the Polish Army of the Duchy of Warsaw, and then of the Kingdom of Poland. Unfortunately, the level of medicine and overall hygiene prevented the elimination of the disease, which is still one of the most common causes of blindness in Third World countries (in Africa, Asia, Central and South America). Owing to the great effort of several generations of ophthalmologists, it was eventually eradicated in the 1950s in Poland. It is undoubtedly one of the greatest successes of our eye disease specialists, although not widely known. Young Polish ophthalmologists do not have to tackle this issue only thanks to the hard work of the previous generations.
It is worth noting that among the patients of the authors there are still people expatriated from the Vilnius Region (in the interwar period an area where trachoma escalated the most) who were effectively treated for trachoma before the outbreak of the Second World War. In spite of their advanced age and certain noticeable complications, they have retained a usable visual acuity.

The development of ophthalmology also permanently influenced the regulations concerning military service. It should be noted that diseases which precluded military service (e.g., cataract, squint, myopia) can be treated effectively thanks to advancements in medicine and allow those willing to become soldiers. However, some eye diseases still make it impossible to pursue dreams of military service (e.g., blindness, amblyopia etc.). Perhaps the future will bring another breakthrough in ophthalmology that would make the treatment of currently incurable diseases possible. After all, the 19th century Polish military surgeons would be rubbing their eyes in astonishment and elation at the possibilities provided by contemporary medicine. It can be safely assumed that current ophthalmologists would be similarly shocked if they saw the state of the discipline 150 years from now, but this is to be seen by their successors.

**Literature**

5. Archive of the 105th Military Hospital with an Independent Public Health Care Clinic: KSG: p. 211
6. Giedroyć F. Służba zdrowia w dawnym Wojsku Polskim [Medical services in the former Polish Army]. Warsaw 1927: 79-80, 109, 209-210

Henryk Dyczek
Polonia Academy in Częstochowa; head: Prof. Jerzy Supady MD, PhD

Abstract. Lieutenant-Colonel Antoni Tomasz Aleksander Jurasz, professor of medicine (1882–1961) was an outstanding man – a surgeon, a scientist and a community worker. Born in Prussia to a Polish father and English mother, he dedicated all his skills to Poland, the homeland of his father, Antoni Stanisław Jurasz, after it regained its independence in 1918. He continued his work for Poland despite the outbreak of the Second World War. The purpose of this series of five articles is to present the cause-and-effect analysis of his development, work and achievements.

Key words: Antoni Tomasz Aleksander Jurasz


Słowa kluczowe: Antoni Tomasz Aleksander Jurasz

Delivered: 13/10/2015. Accepted for print: 01/12/2015. No conflicts of interest were declared.

Mil. Phys., 2016; 94 (1): 97-100

Copyright by Military Institute of Medicine

Academic Sports Association in Poznań, and an active branch of the Polish Red Cross in the Wielkopolskie region. With the Second World War still not over, Jurasz was already organizing the equipment needed for Polish hospitals with the restoration of the Polish health care system in mind. Unfortunately, it was not appreciated by the later Polish communist government, and, forced to emigrate, he died in New York.

The first part of the work is dedicated to his family and school environment, the second part discusses his professional life before the outbreak of the Second World War, the third describes the events of 1939 and the creation of the Polish Medical Faculty at the University of Edinburgh, the fourth is devoted to his post-war life while the fifth sums up his life and scientific accomplishments.
Part V

Antoni Tomasz was an authority for others [1], one of the most outstanding Polish surgeons of the interwar period and a scientist with an international reputation [2]. His contemporaries included many friends as well as people hostile to him. A man of high class, an altruist and patriot, whose life was incredibly colorful and full [3]. He co-founded the health care system for the Polish Armed Forces during his stay in Edinburgh in Scotland during the years of the Second World War. An outstanding pedagogue, scientist, community worker, friend of the youth and a devoted patriot [4].

Once Poland regained its independence, he created one of the most modern centers of surgery in Europe at the University of Poznań and the Transfiguration Hospital. This was possible owing to his rich clinical experience, gained while working as the assistant to famous German surgeons. In the period of the Second World War, when all Polish universities were closed down, he founded the Polish Medical Faculty (PMF) at the University of Edinburgh, with Polish as the main language of instruction. This faculty was intended to be transferred to Poland after its liberation from German occupation. Jurasz exhibited incredible receptivity to knowledge in his brilliantly mastered profession [5]. One of his teachers, Professor Michels from the German Hospital in London, where Jurasz served his first apprenticeship, wrote in a letter of recommendation to St. Mary's Hospital in Frankfurt am Main, dated 28 January 1915, that he was a man of honesty and integrity, whose character traits resulted in Jurasz remaining his dear friend, one whose cooperation with surgeon colleagues and patients was very successful [6]. Professor Payr, assisted by Jurasz for almost 5 years, had a similar opinion. In a letter of recommendation of 23 January 1915 to the same hospital he described Jurasz as an extremely humane person, both towards the patients and his colleagues, as well as the medical staff of the hospital [6].

The clinical resources available to Jurasz in pre-war Poland covered an extremely wide range of specializations, such as modern anesthesiology, endocrine surgery, surgical treatment of bone and joint tuberculosis, gastroenterology, neurosurgery, oncology and urology. Over the years, Jurasz contributed through...
his clinical and educational activities to the education of a number of outstanding surgeons, including: Ludwik Błażejek, Alfred Barlik, Stanisław Bylina, Roman Drews, Zygmunt Górką, Maria Grabska, Józef Granatowicz, Jerzy Jasieński, Władysław Kowalewski, Jan Krotoski, Czesław Maciejewski, Lucjan Mierzejewski, Ludwik Niczyperowicz, Zbigniew Pieniążyński, Feliks Skubiszewski, Tadeusz Suwalski, and Rudolf Strutyński [7]. Some of them took up chairs of surgery in Poland after 1945.

In 1921 Jurasz was engaged in the habilitation programs of Jan Krotoski PhD and Feliks Skubiszewski PhD, but he also headed the habilitation programs of Leon Kleczkowski PhD (1922) and Kazimierz Nowakowski PhD (1923) [8]. Following the death of Professor Ireneusz Wierzejewski, he took over as the supervisor of the habilitation of Franciszek Raszeja in 1931 and Wiktor Dega in 1933. At the University of Poznań he supervised the doctoral dissertations of Stanisław Dziedziuchowicz, Feliks Kończała, Danuta Latinek-Ciążyńska, Feliks S. Ratański, Willy R. Sarrazin, Zbigniew T. Smukalski and Alfons C. Włodarczyk [7]. One of his assistants, Maj. Czesław Maciejewski PhD, held the post of medical director of surgery in Gdynia, whereas during the time of war he became the chief surgeon of the Military Hospital in Ancona, with several hundred beds [9].

In 1914, before the outbreak of the First World War, Jurasz presented his experiments in the treatment of gastric and duodenal ulcers at the international congress of surgeons in New York [10], where he represented the university clinic in Leipzig [11]. In 1926, already as a professor of the University of Poznań, he shared the results of his experience in the treatment of Graves' disease. In the same year, at a congress of surgeons in Rome, he presented procedures for the surgical treatment of the spleen. Invited by the Little Entente, he travelled with his assistants in 1935 to Bucharest and conducted demonstration operations in local hospitals [12]. He also shared his surgical skills in South America, where he was a guest of the Brazilian Medical Academy in the years 1935-1936, where he also conducted a series of lectures in Rio de Janeiro, São Paulo and Curitiba. In recognition of his surgical skills, in 1934 he became a foreign member of the French Academy of Surgeons in Paris and in 1935 an honorary member of the Brazilian and Paranian Academy of Medicine [10]. He was a guest in Dubrovnik, Belgrade and Ragusa at the congresses of Yugoslavian physicians. In Karlsbad, he led lectures at the international professional development courses for surgeons [7]. Together with Prof. Maksymilian Rutkowski (1867-1942) he edited the surgical section in "Nowiny Lekarskie" [10], and from 1927 the "Chirurgia Kliniczna" journal, which in 1929, owing to his endeavors, began to be published in an English version ("Chirurgia Clinica Polonica"). In cooperation with Professor Wierzejewski (1881-1930) [10], in 1928 [12] he organized the Polish Society of Surgeons and Orthopedists of Western Poland, for which he served as chairman in the years 1927-1939 [13]. In cooperation with Associate Professor Feliks Skubiszewski (1895-1981) from the Faculty of Medicine in Poznań, he prepared in 1937 [12] the chapters on hepatic, gastric and pancreatic surgery for a textbook of surgery. In cooperation with Professor Władysław Antoni Gluziński (1856-1935) and Professor Adam Karwowski (1873-1933), he founded the Pan-Slavic Medical Association, as a result of which Polish was recognized as the language of instruction at the Congress of Polish Surgeons, and in 1932, as a representative of Poland owing to his earlier recognition [10], at the IX Congress of Societe Internationale de Chirurgie (9th Congress of the International Society of Surgery) [12] in Madrid he presented his paper in Polish.

This does not mean that Jurasz was not familiar with foreign languages: on the contrary, he was a polyglot!
He was fluent in speaking and writing in English, French and German. His linguistic knowledge, contacts in the scientific community, which he developed during his foreign practices, as well as his vast knowledge resulted in him repeatedly being the official delegate of Poland at international surgical forums. In recognition of his accomplishments in the field of science and his remarkable presentation of Polish science in the world, he received the Commander’s Cross of Polonia Restituta [10]. He was an honorary member of eight foreign surgical associations and a regular member of seven foreign scientific surgical associations [4].

The foundation of the Polish Medical Faculty with the Polish Paderewski Hospital in Edinburgh is an example of not only international humanitarian aid in a time of war, but also a confirmation of the character traits of its founder, Professor Antoni Tomasz Jurasz, whose life motto was to aid his fellow humans regardless of the difficulties that might arise. These values remained dear to him after the end of the Second World War, when, despite his advanced age, he wished to continue his work on the development of Polish medicine, which he had started in the interwar period.

Unfortunately, the political situation and the hostility of the communist authorities under the dictatorship of Moscow did not allow that. Moreover, the perfidy of these authorities meant smears were directed at him, which resulted in him being forced to emigrate in order to protect himself from the atrocity of their activities.

A senior assistant of Jurasz in Poznań [14] from 1934, and later his friend, Professor Roman Drews, who met Jurasz in Dublin a few days before his sudden death in New York, claimed [10]: “he was definitely a figure that will leave an indelible mark in the history of Polish medicine, especially that of Greater Poland”. F. Znaniecki PhD, lecturer at the University of Poznań before 1939, considered Jurasz to belong to “the highest category of people due to his incredible skills and moral qualifications” [15].

The great love of Professor Antoni Tomasz Jurasz for all that is Polish, confirmed by his endeavors for recognition of Polish as a language of international conferences [10] and his personal involvement in the purchase of Polish land from Germanized Kashubians [16], was reflected on his gravestone at Cytadela in Poznań “(...) rightfully states that he was a relentless advocate for Poland all around the world” [1].

**Literature**

1. Rostański W. Rodzina Karolyny z Gaspeyów Juraszowej, matki mojej mamy [The family of Caroline Jurasz, née Gaspey, my mother’s mother], 1991: 3
5. Janta-Polczyńska A. Wspomnienia o wuju Antonim Jurasz, p. 3 [Memories of Uncle Antoni Jurasz].
9. Majewski A. Wojna, ludzie i medycyna [War, people and medicine], Lublin 1969: 553
10. Drews R. Wkład lekarzy i farmaceutów wielkopolskich do rozwoju nauk medycznych [Contribution of Greater Poland doctors and pharmacists in the development of medical sciences]. Yearbooks of the Medical Academy in Poznań, Warsaw–Poznań 1975; (Suppl. 2: 8, 10, 11)
They were the authors of the Military Physician journal in the interwar period. University of Warsaw lecturers in the journal's first decade. Part II

Oni tworzyli „Lekarza Wojskowego” w okresie dwudziestolecia międzywojennego. Wykładowcy Uniwersytetu Warszawskiego w pierwszym dziesięcioleciu działalności czasopisma. Część II

Danuta Augustynowicz1, Aleksandra Karolak1, Hanna Grodzka2, Andrzej Kosater2

1 Section of Scientific Research Strategy and Development, Military Institute of Medicine in Warsaw; head: Danuta Augustynowicz MSc
2 Scientific Library, Military Institute of Medicine; head: Anna Kot MSc

Abstract. At the foundation of Warsaw University in 1816, medicine formed one of its five original departments established by the edict of Tsar Alexander I. The university was a sanctuary of Polish identity and an important scientific and teaching center. The goal of this article, being the second from a series entitled “They were the authors of the Military Physician journal in the interwar period” is an attempt to present the contributions to the journal made by the University professors in the 1920s. The material is divided into two parts, and currently the authors introduce the contributors devoted to clinical sciences. The group consisted of deans, assistants, future lecturers and deans of scientific centers: Edward Żebrowski, Zdzisław Gorecki, Eleonora Reicher, Aleksander Rytel, Leon Kryński, Zygmunt Radliński, Jerzy Rutkowski, Bronisław Sawicki, Marian Grzybowski, Rudolf Arend and ZygmuntMessing. The second part of the article, focusing on the contributors devoted to theoretical sciences, will be published in the following issue of this journal.

Key words: history of 20th century medicine, medical journals, physicians


Słowa kluczowe: historia medycyny XX w., czasopisma medyczne, lekarze

Delivered: 29/11/2015
Accepted for print: 01/12/2015
No conflicts of interest were declared.
Mil. Phys., 2016; 94 (1): 101-110
Copyright by Military Institute of Medicine

Corresponding author
Danuta Augustynowicz MSc
Military Institute of Medicine, Scientific Division
128 Szaserów St., 04-141 Warsaw
telephone: +48 22 261 816 705, 665 707 460
e-mail: daugustynowicz@wim.mil.pl

Delivered: 29/11/2015
Accepted for print: 01/12/2015
No conflicts of interest were declared.
Mil. Phys., 2016; 94 (1): 101-110
Copyright by Military Institute of Medicine

Corresponding author
Danuta Augustynowicz MSc
Military Institute of Medicine, Scientific Division
128 Szaserów St., 04-141 Warsaw
telephone: +48 22 261 816 705, 665 707 460
e-mail: daugustynowicz@wim.mil.pl
Only a life lived for others is a life worth living.
Albert Einstein

A professor of the Medical Faculty should, first of all, be a scientist, second, be a teacher and, third, be an educator; a harmonious combination of these conditions constituting the flawless ideal of a professor.
Adam Wrzosek

The close relationship of the University of Warsaw (Fig. 1) with Military Physician dates back to 31 October 1922, when the Military Sanitary School (MSS) was founded, to educate professional military physicians. The students received education in a two-course system: medical at the Medical or Pharmaceutical Faculty of the University of Warsaw or at the State Institute of Dentistry, as well as military and medical education at the Officer Cadet School. On 14 November, during the inauguration of the activity of the Military Sanitary School, an oath was taken by 42 cadets of the first year, in the presence of the heads of military health care and the Dean of the Medical Faculty at the University of Warsaw, Prof. Mieczysław Michałowicz PhD [1].

The relations between the Sanitary Training Centre and Military Physician were not a coincidence: "The main aim of the School is, after all, to educate the future corps of military physicians, unite it by means of shared ideas and doctrine, for it to create in the future an efficient and ideal tool for the protection of the living forces of the nation as required in times of war" [2].

Military Physician published articles written by many outstanding lecturers, who presented the results of research conducted at the university departments, institutes and laboratories. In 1921, the Medical Faculty of the University of Warsaw had 15 research departments, 11 clinics (4 more clinics were opened and the Roentgen Institute was founded later), as well as a medicinal plant garden. A department of Pharmacy functioned at the faculty, having its own three research departments. The academic staff of the University of Warsaw, in accordance with the act of 13 July 1920 (Fig. 2) and the statute of the University, was formed by honorary professors, full professors, associate professors, assistant professors, deputy professors, foreign language instructors and teachers of practical skills.

The duties of the full and associate professors primarily included conducting scientific research, lecturing and running classes for students. Honorary professors were only obliged to conduct scientific research. The auxiliary academic staff included assistant professors, curators, pathologists, senior and junior assistants, as well as volunteer assistants, and the task of this group was to aid the heads of the departments in teaching, research and administrative work, as well as their own scientific work [3].

Figure 1. Warsaw University (from the authors' collection)
Rycina 1. Uniwersytet Warszawski (ze zbioru autorów)
The 1920s were also a period of development for specialist medical periodicals related to the activities of the medical faculties of Polish universities. A total of 20 journals focusing on single subjects appeared in that period, devoted among other things to internal diseases, surgery, neoplasms, ophthalmology, otolaryngology and radiology. In the years 1919-1924, the number of journals increased by 26 new titles, which included Military Physician, "Pediatria Polska", "Klinika Oczna" and "Nowiny Psychiatryczne". The development of medical journals was a result of the professional work of physicians, related to their scientific work. Sharing the results of scientific research was and still remains one of the main duties of scientists, especially those associated with medicine, and the role of journals is, apart from providing professional education, also to be a forum for the exchange of information about the most recent scientific achievements. Stanisław Konopka claimed that "(...) a journal provides a reliable image of the development of medical thought" [4]. In his work "Rozwój nauk medycznych w Polsce" ["Development of medical sciences in Poland"], Romuald Gutt wrote: "in the interwar period a good teacher was primarily a good and often an outstanding practitioner (...). They certainly conducted scientific work, but they were more associated with the previous century" [5, 6].

In the analysis of the content of Military Physician he takes note of the interdisciplinary nature of the journal and the kind of works presented there, where next to case descriptions, playing the role of an educational medium for the future and young physicians, original works exploring the most recent ideas were published, broadening the horizons of the readers, as well as initiating and facilitating scientific work. It is significant that the journal inaugurated its existence with the publications of two professors of the University of Warsaw: Władysław Antoni Gluziński and Alfred Sokolowski. The author of the third work, Bronisław Sawicki, held the title of honorary professor at the University of Warsaw, and in 1922 he began giving lectures on general surgery there, and continuing to do so for the following two years.

Heads and lecturers from the thirteen departments of the University cooperated with Military Physician from the time it was first published, representing clinical sciences, theoretical sciences, philosophy, linguistics and veterinary medicine. They were: First Department and Clinic of Internal Diseases, Second Department and Clinic of Surgery, Second Department and Clinic of Surgery, Department and Clinic of Dermatology and Venereology, Department of Psychiatry and Neurological Diseases, Department and Institute of Descriptive Anatomy, Department and Institute of Pathological Anatomy, Department and Institute of Physiological Chemistry, Department and Institute of Forensics, Institute of General and Experimental Pathology of the Veterinary School, Department and Institute of History and Philosophy of Medicine, as well as the Department of the Polish Language.

The First Department and Clinic of Internal Diseases was founded in 1918 and was located in a pavilion of the Holy Ghost Hospital at 12 Elektoralna Street. It was headed by an outstanding internal medicine specialist, Professor Kazimierz Rzętkowski. Three employees of the department initiated cooperation with the journal in this decade: Edward Żebrowski, Zdzisław Górecki and Aleksander Rytel [7].

The Second Department and Clinic of Internal Diseases, founded in 1917 in the Infant Jesus Hospital (Fig. 3), headed by the already mentioned Professor Antoni Gluziński, was the department of Eleonora Reicher, one of the first women employed at the University of Warsaw, a pioneer of sports medicine, the founder of Polish rheumatology (Tab. 1).

Figure 2. Act of 13 July 1920
Rycina 2. Ustawa z 13 lipca 1920 r.

Clinic of Internal Diseases, First Department and Clinic of Surgery, Second Department and Clinic of Surgery, Department and Clinic of Dermatology and Venereology, Department of Psychiatry and Neurological Diseases, Department and Institute of Descriptive Anatomy, Department and Institute of Pathological Anatomy, Department and Institute of Physiological Chemistry, Department and Institute of Forensics, Institute of General and Experimental Pathology of the Veterinary School, Department and Institute of History and Philosophy of Medicine, as well as the Department of the Polish Language.

The First Department and Clinic of Internal Diseases was founded in 1918 and was located in a pavilion of the Holy Ghost Hospital at 12 Elektoralna Street. It was headed by an outstanding internal medicine specialist, Professor Kazimierz Rzętkowski. Three employees of the department initiated cooperation with the journal in this decade: Edward Żebrowski, Zdzisław Górecki and Aleksander Rytel [7].

The Second Department and Clinic of Internal Diseases, founded in 1917 in the Infant Jesus Hospital (Fig. 3), headed by the already mentioned Professor Antoni Gluziński, was the department of Eleonora Reicher, one of the first women employed at the University of Warsaw, a pioneer of sports medicine, the founder of Polish rheumatology (Tab. 1).

There were also two surgery clinics at the university, located in the Infant Jesus Hospital and the Holy Ghost

---

Hospital [7]. Five articles on surgery authored by the employees of both clinics appeared in the discussed period: by Leon Kryński, the first Head of the First Department and Clinic of Surgery, simultaneously lecturing on anatomy, and Zygmunt Radliński, Head of the Second Department and Clinic of Surgery from 1920, as well as the organizer and curator of the First Roentgen Institute, founded in 1921.

The circle of famous surgeons and lecturers of the University of Warsaw also included Professor Bronisław Sawicki (Tab. 2).

An outstanding scientist of the University of Warsaw, with a reputation reaching beyond the borders of Poland, was Professor Franciszek Krzyształowicz – a histopathologist, the first Head of the Department and Clinic of Dermatology and Venereology in the years 1920-1931 [7]. This is the period in which two works were published in Military Physician that were authored by his assistant, Marian Grzybowski, who in 1931 took over as the Head of the Clinic.

1929 was the year in which a work by Rudolf Arend and Zygmunt Messing was published, both from the Department and Clinic of Neurology, founded in 1920 and headed by Kazimierz Orzechowski, an associate professor at the University of Lwow (Tab. 3) [7].

Summary

The University of Warsaw was the largest university in the country, gathering the most numerous group of research and teaching staff, as well as students. Its fate was closely related to the fate of Poland and its society. Tens of thousands of people passed through the walls of the University of Warsaw in this period. The authors publishing in the pages of Military Physician made up the core of the research and teaching staff of the university, and their works were a valuable contribution to the development of medicine.

Figure 3. Infant Jesus Hospital in Warsaw, Tygodnik Ilustrowany 1901; 41: 813
Rycina 3. Szpital Dzieciątka Jezus w Warszawie, Tygodnik Ilustrowany 1901; 41: 813

Edward Żebrowski (born 31/05/1872, died 26/06/1930) graduated from the Imperial Military Medical Academy in Saint Petersburg in 1896. He worked at the University in Kiev, and then at the University in Kharkiv. In 1919, he returned to Poland, and in 1920, joined the ranks of the Polish Army and in the same year became a member of the Military Sanitary Council. Appointed a head of research at the internal departments of the Ujazdów Hospital, he gained recognition as a scientist, a great lecturer and organizer. At the same time, he was a physician directing the resorts in Druskienniki, which he was devoted to protect. He also became the first chairman of the Druskienniki Medical Society. In 1927 he took the position of the Head of the First Department and Clinic of Internal Diseases at the University of Warsaw. He was an outstanding cardiologist, a great diagnostician and a prominent educator of medical students, and a chairman of the Polish Society of Internal Medicine. He was awarded the Knight's Cross of the Order of Polonia Restituta (1924), Officer of the Order of Academic Palms – French Third Republic (1927) [7-9].

Zdzisław Gorecki (born 13/02/1895, died 13/09/1944) graduated from the University of Lwow in 1921. After his studies, he moved to Warsaw and started work as an assistant at the First Clinic of Internal Diseases of the University of Warsaw, headed by Prof. Antoni Gluziński, and in 1925 transferred to the Second Clinic, where he was entrusted with the post of head of the department (1932–1939). His interests included pulmonary and pleural diseases, pathology of blood circulation and metabolism, as well as bowel diseases. He was the organizer of the Gasometric Laboratory and the Hematological Laboratory, he founded the first Internal Department of Occupational Diseases in Poland, and in 1938 the first Department of Occupational Diseases in Poland. He was a secretary of the Management Board of the Polish Society of Internal Medicine, a founding member of the Association for Scientific Research on Tuberculosis, and the editor of publications of the Warsaw Medical Society. From 12/06/1934 he held the function of member of the Higher Medical Board at the Ministry of Social Welfare. In 1942, he became the director of the Social Insurance Hospital at 231 Czerniakowska Street in Warsaw [10].

Aleksander Rytel (born 30/03/1896, died 15/11/1984) studied law and medicine at the University in Kharkiv. In the years 1918–1920, he volunteered as a physician in the Polish Army. After the end of the war he continued his studies at the University of Warsaw, and after graduating in 1923 he started work at the First Clinic of Internal Diseases alongside Professor Edward Żebrowski. In the years 1923–1938 he was first an assistant and then a senior assistant at the First Clinic of Internal Diseases at the University of Warsaw, and at the same time a physician at the Social Insurance Institution. In 1934, he became the head of a ward of the Wola Hospital in Warsaw on Płocka Street, and subsequently its director in 1938. A few weeks before the outbreak of the war, Aleksander Rytel went to the USA and Canada in order to learn more about the methods of combating tuberculosis there. He did not return to Poland, but settled in Canada and worked at the Faculty of Medicine at the University of Toronto.

He was a well-recognized internal medicine specialist, his publications on cardiology, digestive processes, metabolism, blood coagulation, pulmonary diseases, and later also tropical diseases and joint diseases, appeared in general medicine and specialist journals, and he also wrote for daily newspapers in Warsaw. Aleksander Rytel PhD supported many social initiatives, such as the celebration of the Millennium of Poland in Chicago or the construction of the Nicolaus Copernicus Monument in Chicago. He was the founder and chairman of the Association of Polish Medical Doctors, the editor and publisher of the "Polish Medical Science and History Bulletin". It is thanks to him that the government of the United States waived the ban on the export of the poliomyelitis vaccine manufactured in the USA. In 1976 he was honored by the Medical Academy in Warsaw with a degree of honoris causa. He also received the American Wisdom and Honor Award [11, 12].
Eleonora Reicher (born 29/09/1884, died 12/03/1973) studied at the Sorbonne in Paris, and then in Bern, where in 1912 she received her PhD degree in natural sciences. In the years 1914-1916, she worked as a physician behind the front line in Mogielnica near Grójec, organizing field hospitals and a hospital for people infected with typhus. She received her medical diploma in Bern in 1917. After returning to Poland, she was employed from 1921 at the Second Clinic of Internal Diseases in 1921; organizing its Physical Education Centre, where she was an assistant professor in the years 1927-1939. She was also credited with the foundation of the first Antirheumatic Centre at the Clinic, which she headed until 1939. She conducted lectures on rheumatic diseases and the diseases of the vegetovascular system at the Medical Faculty. During the Warsaw Uprising in 1944, she was a physician at the hospital on Rakowiecka Street. In spring 1945, she started working as an assistant professor at the University of Warsaw, from 1947 as a professor. She organized the first rheumatology center in Warsaw on Wiejska Street, later the center was located in her apartment at 40 Polna Street and became the germ of the National Institute of Rheumatology, of which she became a director. In the years 1949-1956 she headed the Chair of Rheumatology of the Medical Faculty at the University of Warsaw [7, 13, 14].

Publications in Military Physician
- Zagadnienia organizacji wychowania fizycznego [Issues in the organization of physical education]. 1927; 10 (4): 354-369

Zygmunt Radliński (born 20/04/1874, died 31/12/1941) began medical studies at the Medical Faculty at the University of Warsaw in 1893, but in the following year he was expelled from the university with a ban on studying at any Russian university for participation in a manifestation to celebrate the 100th anniversary of the Kościuszko Uprising. Owing to the endeavors of his mother he was allowed to finish his studies at the University of Kiev and in 1899 he received his medical diploma cum eximia laude. In 1902, he moved to Warsaw, where he worked in the surgical wards of the Infant Jesus Hospital. In 1905, he was arrested for political activities and sentenced to five years' exile in Siberia, from where he managed to escape and settle in Kraków. In 1919, he was appointed the head of a ward and chief surgeon at the military Ujazdów Hospital in Warsaw with the rank of Lieutenant Colonel, and in 1920 the Medical Faculty of the University of Warsaw entrusted him with the post of Head of the First Surgery Clinic. He was a great diagnostician, operating surgeon, educator and teacher, and founder of a school of surgery. His works focused on war surgery, thoracic surgery, abdominal surgery, neurosurgery, as well as bone, vascular, urologic and oncologic surgery. He introduced his own numerous methods and modifications, many of which contributed to the development of surgical techniques. He was a great teacher, his lectures were beautiful in their form and rich in content. He was a co-founder and the first editor of "Polski Przegląd Chirurgiczny", a member of Polish and foreign societies of surgeons and a vice chairman of the Polish Gastrological Society. He was an active participant in international scientific congresses. He was one of the first members of the Polish Freethinkers Association (PFA) and the Polish Freethought Society. After he retired, during the Second World War, he continued a private practice, and he was an honorary consultant for the First Surgery Clinic and published in the underground press [7, 15, 16].

Publications in Military Physician
- Kikut a proteza [A stump and a prosthesis]. 1921; 2 (1): 1-6
- Przyczynek do chirurgii jamy czaszkowej [A contribution to surgery of the cranial cavity]. 1920; 1 (2): 1-6
- Leczenie uszkodzeń nerwów obwodowych [Treatment of peripheral nerve damage]. 1921; 2 (45): 1433-1438
### Table 1. Internal medicine publications

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Title</th>
<th>Journal</th>
<th>Volume/Issue</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antoni Głuziński</td>
<td>O stosunku zmian w gruczołach o wewnętrznym wydzielaniu do schorzeń układu mięśniowego</td>
<td>Military Physician</td>
<td>1 (1)</td>
<td>4-13</td>
</tr>
<tr>
<td></td>
<td>Skazy kwoteczne po zastosowaniu przetworów arszenobenzolowych</td>
<td>Military Physician</td>
<td>4 (6)</td>
<td>458-467</td>
</tr>
<tr>
<td>Zdzisław Gorecki</td>
<td>Parę słów o witaminach</td>
<td>Military Physician</td>
<td>6 (8)</td>
<td>725-738</td>
</tr>
<tr>
<td>Eleonora Reicher</td>
<td>Zagadnienia organizacji wychowania fizycznego</td>
<td>Military Physician</td>
<td>10 (4)</td>
<td>354-369</td>
</tr>
<tr>
<td>Aleksander Rytel, Władysław Klonowski</td>
<td>Przypadek duru osutkowego powikłanego paradurem C</td>
<td>Military Physician</td>
<td>6 (3)</td>
<td>197-201</td>
</tr>
<tr>
<td>Aleksander Rytel, Mikołaj Dziewanowski</td>
<td>O stosowaniu jodu w gruźlicy. Część I Wartość lecznicza jecorolu</td>
<td>Military Physician</td>
<td>17 (5/8)</td>
<td>191-206</td>
</tr>
<tr>
<td>Edward Żebrowski</td>
<td>Istota i podział anemji</td>
<td>Military Physician</td>
<td>5 (3)</td>
<td>185-203, 276-298</td>
</tr>
<tr>
<td>Edward Żebrowski, Leon Karwacki, Paweł Baron</td>
<td>Przypadek posocznicy, wywołanej przez prątki okrężnicy</td>
<td>Military Physician</td>
<td>6 (6)</td>
<td>400-407</td>
</tr>
</tbody>
</table>

**Bronisław Sawicki** (born 06/04/1860, died 11/01/1931) graduated in 1884 from his medical studies at the Imperial University of Warsaw and became an assistant at the Second Faculty and Clinic of Surgery. In the years 1884-1896 and 1893-1903, he was a surgeon at Jan Bączkiewicz's Department of Pediatrics at 42 Leszno Street, where he organized the first modern department of pediatric surgery in Warsaw. In the years 1889-1905, he taught surgery at a feldsher school in Warsaw, for a year he gave lectures on dental surgery at the first school of dentistry in Warsaw founded by Jakub Levy. In 1896, he became the head of the female surgery ward at the Infant Jesus Hospital on Warecki Square, and in 1907 he became the head of the First Surgical Ward. He gained his knowledge and experience by visiting top surgical centers. He successfully applied the achievements of international surgery in his own center. He did not accept the proposal of taking up the Chair of Surgery at the newly founded university, explaining his decision with his old age, but he participated in the design of the curriculum. In July 1919, he was appointed an honorary professor of the University of Warsaw and accepted the role of a university lecturer. In the years 1922-1924, he gave lectures on general therapy in surgery, and then for the rest of his life on general surgery and nursing. In the field of science he focused on abdominal, vascular and peripheral nerve surgery, as well as traumatology and neurophysiology. He was one of the most versatile Polish surgeons at the end of the 19th century [15, 21, 22].

**Publications in Military Physician**

- Dwa rzadkie przypadki złośliwych guzów tarczycy [Two rare cases of malignant thyroid tumors] 1920; 1 (1): 13-22
- Dwa rzadkie przypadki złośliwych guzów tarczycy (dokończenie) [Two rare cases of malignant thyroid tumors (final part)] 1920; 1 (2): 6-10
<table>
<thead>
<tr>
<th>Table 2. Surgery publications</th>
<th>Tabela 2. Publikacje z zakresu chirurgii</th>
</tr>
</thead>
<tbody>
<tr>
<td>clinical sciences – surgery</td>
<td></td>
</tr>
<tr>
<td>1. Leon Kryński</td>
<td></td>
</tr>
<tr>
<td>2. Zygmunt Radliński</td>
<td></td>
</tr>
<tr>
<td>Kikut a proteza [A stump and a prosthesis] – Military Physician 1921; 2 (1): 1-6</td>
<td></td>
</tr>
<tr>
<td>Leczenie uszkodzeń nerwów obwodowych [Treatment of peripheral nerve damage] – Military Physician 1921; 2 (45): 1433-1438</td>
<td></td>
</tr>
<tr>
<td>3. Jerzy Rutkowski</td>
<td></td>
</tr>
<tr>
<td>O resekcji naczyń powrózka nasiennego [About the resection of the spermatic cord vessels] – Military Physician 1924; 5 (3): 219-224</td>
<td></td>
</tr>
<tr>
<td>4. Bronisław Sawicki</td>
<td></td>
</tr>
<tr>
<td>Dwa rzadkie przypadki złośliwych guzów tarczycy [Two rare cases of malignant thyroid tumors] – Military Physician 1920; 1 (1): 13-22</td>
<td></td>
</tr>
<tr>
<td>Dwa rzadkie przypadki złośliwych guzów tarczycy (dokonczenie) [Two rare cases of malignant thyroid tumors (final part)] – Military Physician 1920; 1 (2): 6-10</td>
<td></td>
</tr>
</tbody>
</table>

Jerzy Rutkowski (born 24/02/1890, died 24/05/1972) was one of the alumni of Professor Radliński, graduating from the University in Moscow in 1918. He continued his medical studies in Paris, Heidelberg and Vienna.

From 1920, he was affiliated with the Second Surgery Clinic. He was one of the pioneers in blood donation, hemotherapy (he conducted transfusions in the 1920s) and controlled hypotension operations. He was also the creator of a direct blood transfusion apparatus, which was used for a long time after the Second World War. The scientific and research work conducted by Rutkowski in the clinic resulted in articles, in which he described, among other things, a rare nosological entity - latent breast carcinoma, diagnosis of subphrenic abscesses by means of injecting air, recognizing symptoms of dissociated sensory loss and adipose tissue loss in chronic appendicitis, and the lateral sternal puncture method. In 1935 he published a three-volume handbook *Chirurgia* ["Surgery"]. He was an author of works on surgery, anesthesiology, urology, transfusiology, oncology and the history of medicine. He developed an original surgical treatment method for bronchial asthma. In the years 1936-1944 he was the head of the Second Surgical Ward at the Infant Jesus Hospital and simultaneously an assistant professor (1933-1943) at the Maria Curie-Skłodowska Radium Institute in Warsaw. He moved to Zakopane, where he ran a private practice and worked at the co-operative clinic. In the autumn of 1945, he took the position of Head of the Second Clinic of Surgery at the University of Łódź. At the same time he was appointed the director of the Polish Red Cross Hospital in Łódź. In 1946, he was appointed a full professor of surgery. In September 1954, he was transferred to Warsaw to the position of Head of the Second Department of General Surgery at the Institute of Medical Staff Training and Specialization and at the same time appointed the medical director of the Department of Surgery at Municipal Hospital No. 6 in Warsaw. He was a member of the Board of Experimental and Clinical Medicine of the Polish Academy of Learning [15, 17-20].

Publications in Military Physician

- O resekcji naczyń powrózka nasiennego [About the resection of the spermatic cord vessels] – Military Physician 1924; 5 (3): 219-224
Marian Grzybowski (born 02/07/1895, died 11/12/1949) graduated from his medical studies at the Military Medical Academy of Saint Petersburg in 1917, and from 1922 worked at the Clinic of Dermatology of the University of Warsaw.

In 1930, he received a PhD degree, and next year he took over as the head of the Clinic of Dermatology on Nowogrodzka Street. In 1935, he received the degree of associate professor. He focused, among other things, on histopathology of the skin, skin atrophy, leukemia, mycosis fungoides and erythema nodosum. His works devoted to the Bowen’s disease and Kaposi’s sarcoma, as well as the description of dermatomyositis, are still valid and up-to-date. Professor Grzybowski was the first to identify connective tissue diseases and autoimmune diseases, he also described a variant of keratoacanthoma, presently referred to as Grzybowski’s eruptive keratoacanthoma. He conducted research devoted to the use of different pharmacological agents in the treatment of skin diseases, he also dealt with venereology, particularly with syphilis; he confirmed that the use of penicillin brought a breakthrough in its treatment. He was one of the first organizers of Operation “W”. During the occupation he stayed in Warsaw, where he managed a clinic, organized underground education and engaged in underground activities. He died in unexplained circumstances [23-26].

Publications in Military Physician

- **Sprawozdanie z przebiegu drugiego zjazdu eugenicznego** [Report from the second eugenics congress] 1921; 2 (48): 1632–1541
- **Jeszcze w sprawie tak zw. „Syflimetry”** [More on the matter of ‘Syphilmetry’] 1928; 11 (5): 412-418
- **Dwoistość zarazka kilowego i istnienie szczepów krótką bladego o powinowactwie z układem nerwowym** [The duality of the syphilis bacterium and the existence of a strain of Treponema pallidum with an affinity to the nervous system] 1923; 4 (2): 122-133

Rudolf Arend (born 1898, died 1980) was a student of Kazimierz Orzechowski. His professional life was associated with the University of Wrocław. In the years 1955–1958, he was the Vice-Chancellor of Didactics at the Medical Academy. In 1963, he received the degree of professor. He founded and developed the neurology school of Wrocław.

His main interests in scientific research were clinical neurology and neuropathology [27].

Publications in Military Physician

- **Medulloblastoma, wychodzące z dna IV komory i ściany wewnętrznej uchyłka bocznego. Medulloblastomatosis opon rdzeniowych** [Medulloblastoma, originating from the bottom of the fourth ventricle and the lateral wall of the lateral recess. Medulloblastomatosis of the meninges] 1929; 14 (1–4): 14-24

Zygmunt Messing (born 08/04/1879, died?) worked as a medical director at the Department of Psychiatry and Neurological Diseases in 1911. According to its statute, the department offered training in neurology and psychiatry. After the restoration of independence, Messing was an assistant professor at the Faculty and Clinic of Neurology (1921–1930), headed by Kazimierz Orzechowski, and then worked in Tworki until 1939 [28].

Publications in Military Physician

- **Medulloblastoma, wychodzące z dna IV komory i ściany wewnętrznej uchyłka bocznego. Medulloblastomatosis opon rdzeniowych** [Medulloblastoma, originating from the bottom of the fourth ventricle and the lateral wall of the lateral recess. Medulloblastomatosis of the meninges] 1929; 14 (1–4): 14-24
HISTORY OF MEDICINE AND MILITARY MEDICAL SERVICES

Table 3. Dermatology and neurology publications
Tabela 3. Publikacje z zakresu dermatologii i neurologii

clinical sciences
dermatology

1. Marian Grzybowski
   - Jeszcze w sprawie tak zw. 'Syfilimetry' [More on the matter of 'Syphilometry'] – Military Physician 1928; 11 (5): 412-418
   - Dwócioste zarażenia kilowego i istnienie szczepów krążka bladego o powinowactwie z układem nerwowym [The duality of the syphilis bacterium and the existence of a strain of Treponema pallidum with an affinity to the nervous system] – Military Physician 1923; 4 (2): 122-133

neurology

2. Rudolf Arend, Zygmunt Messing

Literature

The 90th birthday of Col. Sylwester Czaplicki, professor of medicine, chairman of the editorial board of Military Physician in the years 1970-1990


Abstract. In the period 1972-1983, Col. Sylwester Czaplicki, professor of medicine, now celebrating his 90th birthday, was the commandant of the Post-Graduate Education Institute (IKP) and the Post-Graduate Education Centre (CKP) of the Military Medical Academy (WAM) – the predecessors to the Military Institute of Medicine (WIM). For twenty years, the longest tenure in the 100-year history of “Military Physician”, he was also the Chairman of the Editorial Board of Poland’s oldest periodical on military medicine. In the interview, he recalls his editorial work, teachers, collaborators, editorial problems, selected episodes from his life, studies and military service. He characterizes Gen. Prof. Bolesław Szarecki, to whom he provided medical care in the final phase of the general’s life. Professor Czaplicki concludes the interview with a message to those beginning military medicine: “Those who have not experienced the toil and sweat of military service will never be good military physicians” [the original wording: “Those who have not smelled the odor of soldier’s footwraps will never make good military physicians”].

Key words: Editorial Board, Sylwester Czaplicki


Słowa kluczowe: Sylwester Czaplicki, komitet redakcyjny

Delivered: 04/11/2015
Accepted for print: 01/12/2015
No conflicts of interest were declared.

Corresponding author
Prof. Stanislaw Ilnicki MD, PhD
Department of Psychiatry, Combat Stress and Psychotraumatology, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine
128 Szaserów St., 04-141 Warsaw
e-mail: silnicki@wim.mil.pl
In the background to the 50th jubilee celebrations of the hospital on Szaserów Street, Col. Sylwester Czaplicki, professor of medicine, celebrated his 90th birthday on 4 January 2015. He was the commandant (1972-1983) of the Post-Graduate Education Institute (IKP) and the Post-Graduate Education Centre (CKP) of the Military Medical Academy (WAM) – the predecessors of the Military Institute of Medicine (WIM).

As one of his oldest practicing subordinates, I asked the Professor to share his experiences and thoughts on his life and his work as the editor of “Military Physician”, a position he held for 20 years.

I started work on the editorial staff of “Military Physician” when Col. Stanisław Bober, professor, (1911-1970) was the chairman of the editorial board. At first I worked on a voluntary basis, and then I was appointed to the editorial board in 1958. After Prof. Bober passed away, I became the chairman of the editorial board and I held that position from 1970 to the end of 1990. Although I left the army in October 1990, when I was 65, in order not to hinder the publishing process I continued to edit the journal until the end of 1990. My successor was Col. Edward Stanowski, at the time an associate professor and later a full professor.

In the beginning, “Military Physician” was published monthly, but then regretfully, due to a shortage of paper, which at that time was at a premium, it was decided to publish the journal as a bimonthly. To avoid complications, we published 6 volumes, each containing 2 issues. As a result, every year we had 12 issues in six volumes, each volume published every 2 months, which was a win-win situation.

As a military publication, “Military Physician” was subject to censorship. Administrative and organizational matters were dealt with by the editor, Col. Jerzy Łangowoj MD, PhD (1925-2000) with the invaluable help of Krystyna Szuman, a highly qualified and dedicated editorial secretary.

At that time, the Military Medical Academy published the WAM Bulletin, containing mostly papers authored by the academy's research personnel. They also published supplements with doctoral dissertations, my own included, and habilitation theses. I published my habilitation thesis at my own expense. To maintain a balance I strived to make “Military Physician” a valuable contribution to the academic development of the physicians working at the Post-Graduate Education Institute and then at the Post-Graduate Education Centre of the Military Medical Academy.

Almost every volume contained an occasional editorial dedicated to important events. Then there were original works, followed by clinical case reports describing rare cases that were difficult from a diagnostic point of view. There were also reviews and sometimes summaries of selected articles from foreign medical journals, mostly (but not only) from “Wojenno-Medicinski Żurnal”. Next came the historical section, which was particularly important to me for educational reasons, and which was successfully covered by Col. Witold Lisowski. This structure of the journal was maintained until my last volume in 1990.

Every paper published in “Military Physician” was reviewed, the initial revision being conducted by Jerzy Łangowoj, who would forward a submitted article to an appropriate reviewer on the basis of its content. If there were no appropriate reviewers available within the editorial board, the article was sent for review to the members of the Advisory Board, which was mostly comprised of the leading military specialists of that time. I read every article myself after receiving the review and before the publication of the paper. After completing the editing process, introducing abbreviations, correcting
nomenclature, and proofreading the article, it was sent back to the author, who was asked to read it and acknowledge the paper in its current form.

I always required authors to read the printout of the first proof and perform an author’s revision. Unfortunately, the effects were varied. Some authors were very diligent, while others left everything to the editors and Ms. Krystyna Szuman. Although she started work without any editorial qualifications, she had great enthusiasm and dedication so that within a short time, and to my delight, she managed to master the arcana of an editorial secretariat. We could always rely on her, she would never let anybody get away with any shortcomings.

The Advisory Board was regularly presented with subsequent volumes of the journal. Additionally, they contributed to the editorial file by inspiring the subject matter of the works and by submitting their own articles. A summary in French was prepared by Col. Tadeusz Roźniakowski PhD, in English by Lt. Col. Przemysław Słomski MD, PhD, whereas a Russian summary was always prepared by Col. Jerzy Langowoj MD, PhD, who also knew German and English.

All articles on the organization and medical support of the army were published in classified volumes. One or two such volumes were published every year. The military unit of the Polish Academy of Sciences evaluated journals published in Poland, including “Military Physician”, on an annual basis. We were always evaluated positively.

The journal was sent to all libraries of the Medical Academies and, as part of an exchange program, with attachés from France, the United Kingdom, the United States of America, the Soviet Union and from other countries. This was beneficial for us because the military medical journals in these countries provided information about the articles published in “Military Physician”.

I owe my passion for the work in the medical press to my former boss, Col. Mieczysław Fejgin, assoc. professor, (1894-1975), later a professor, who at that time was the editor of the fortnightly “Medical News” (“Wiadomości Lekarskie”), published by the PZWL medical publishing house. He appointed me as the editor of the clinical section of that journal, and then later, because of the paper shortage, “Medical News” and “Polish Medical Weekly” (PTL) were merged into one journal. Fortunately, the merger lasted only a year. I am also deeply indebted to the editor-in-chief of PTL at that time, and later my boss, Col. Mieczysław Kędra, professor (1914-1976), and the editor Tadeusz Farna MD, PhD. They taught me how to be a good editor, how to use simple and understandable language, without macaronics and unnecessary foreign terms.

In 1980, after Prof. Andrzej Krotkiewski, the editor-in-chief of PTL passed away, I was offered the position of editor-in-chief of this prestigious journal, which played an important role in the physicians’ postgraduate studies. Sadly, because access to the printing house was rather difficult at that time, the weekly journal started to be published with delays of 2-3 months. I could not come to terms with this situation and, after an ineffective intervention with the PZWL, I tendered my resignation. The position was taken over by Prof. Jan Tatoh.

I do envy the current graphic layout of “Military Physician”, even though I am not very fond of such a large format for the journal. I could not even dream of a layout like that. Also, I have never thought that it would be possible to publish a medical medical journal on paper of such quality. Articles written in foreign languages were never published in “Military Physician”, only translations, such as from Russian. I think that it is acceptable to publish English editions, but I find it inappropriate to publish an article in English, written by a Polish author, in a Polish edition of the journal.

I strongly advocate respect for the written and the printed word. Nowadays, young physicians make use of less and less medical literature. They look for information on the Internet. I resent the eradication of Latin, which is being replaced by English. Abbreviations have become more prevalent, and medical language has become impoverished. Every article must be concise, short and intelligible. A modern physician has no time for reading: what we need are articles “in a pill” – concise, yet rich in content.

I wish the present editors and the advisory board of “Military Physician” all the best in continuing the beautiful traditions of the military medical journal, which I had the honor to co-edit for over a quarter of a century.

On the occasion of your 90th birthday, I would be grateful if you could share with the readers of “Military Physician” some recollections from your life and military service.

My parents came to Warsaw in 1931 from the Ciechanów region. After the uprising, my father worked in the Pawiśle Power Plant in Warsaw. I had two younger siblings. My brother died in 2005, but I still have a sister – Anna Roguska. I first went to school at Public Common School no. 75, named after Antoni Osuchowski, a pro-independence activist. The school occupied two residential buildings – one on Trzech Krzyży Square and the other in a tenement building on the corner of the square and Nowy Świat Street, where the older children had classes. In 1934, both parts of the school were moved to the stories added to a building at...
9 Żurawia Street. There was a hospital there during the war, and the building was destroyed.

In 1938, I finished sixth grade and, following the advice of our class tutor, Ms. Stanisława Radlicka, I set out to continue my education at the Cadet Corps in Lviv. To get in there, I had to undergo tests conducted by a review board in Ujazdów in several pavilions. I was classified as “Able” in all categories, but my urine test revealed that I suffered from a kidney condition and, consequently, I was not approved for military service. I passed all my exams but, due to the poor result of the urine test, probably caused by a dirty bottle, I could not become a cadet. The corps were for families with military backgrounds, and my father had nothing to do with the army.

I was well-prepared for my work as an editor thanks to my two Polish teachers – Stanisław Adamczewski and Hiacynt Ratyński, who were able to develop their students’ appreciation for the beauty of the Polish language and the value of using correct Polish. Stanisław Adamczewski, later a professor of the University of Łódź, was an ardent admirer of Stefan Żeromski’s works, and Hiacynt Ratyński encouraged me to read “An Ancient Tale”. Adamczewski would recite “Crimean Sonnets” beautifully.

Polish classes were held on Rozbrat Street, opposite the building complex of the lower chamber of the Polish parliament, which was protected by guards. Classes were not for free, and some of the classes took place at the professors’ apartments. I took my matura exam in a villa at the back of the Warsaw School of Economics in the immediate vicinity of the Stauferkaserne der Waffen SS on Rakowiecka Street.

Before the outbreak of the war, we lived in a house at 14 Orydynacka Street. When in 1939 the house burned down, we moved temporarily to 35 Długa Street, then to 20 Dobra Street, and we lived at 3 Sapieżyńska Street until the Uprising. The housing office had assigned us this apartment after closing of the ‘small ghetto’. Through the window, across the street and over the wall, which was guarded by Lithuanian riflemen, I could see the uprising in the ghetto.

My mother was terrified of bombardments and in the summer of 1944 we left for Zagościniec, in the direction of Malkinie, in the direction of Malkinie. In the morning on the last Sunday of July 1944, we were woken by a loud clanking noise made by caterpillar tracks. It turned out that it was from Soviet armored troops from near Siedlce which had reached Struga near Radzymin, where they encountered the Hermann Göring Panzer Division, which had been withdrawn from the front-line. Without the support of infantry, the troops were completely broken up. We were driven away from that place on 15 August, when the Warsaw Uprising was already in progress. We had temporary residence cards and we tried to get to our hometown, but we were not allowed to cross the bridge in Modlin because the Ciechanów district was incorporated into the Reich. We decided to go to Pomiechówek, where a fisherman got us across the green border.

Sometime between the end of January and the beginning of February 1945, we returned to Warsaw, where we found only rubble. My father worked on the rebuilding site for the power plant and he found an apartment in a collective house on 3 Maja Street, at number 2. On 20 August 1945, I was called up for army service, where I served as a senior typist at the Regional Military Replenishment Council for the City of Warsaw, at first on Solariego Street, then on Ratuszowa Street, and finally at 11 Listopada Street.

That was where I heard about the enrolment for medical studies at the Department of Military Medicine at the Maria Curie-Skłodowska University in Lublin. The President of the University was Henryk Rabbe, who was also the ambassador in Moscow. After completing the second year, that is after the so-called half-diploma, I received my first job offer from Prof. Stanisław Grzycki at the histology unit and from Prof. Blauth-Opińska at the physiological chemistry unit. I could not take up those offers because the department was dissolved.

I continued my studies for a year, then moved on to the student-officer corps at the 7th District Hospital in Lublin, which was later dissolved and the Academic Companies established. I was assigned to the 1st Academic Company in the Warsaw Citadel. As a warrant officer, I was a part-time physician of the 1st Academic Battalion, established on the basis of the said company. Apart from students of medicine, the battalion was comprised of military students from other fields of study.

Starting from the 3rd year, I continued my studies at the Medical Faculty of the University of Warsaw. I finished my studies in June 1950. I received my medical diploma from the Medical Academy on 12 December 1950, and then in 1951 I completed the Officer Training Course in the Central Hospital of the Ministry of National Defence at Koszykowa Street, where I continued my service as an officer physician in the position of assistant, senior assistant and adjunct in the department of internal diseases, which was headed by: Mieczysław Fejgin (1948-1953), Mieczysława Kędra (1954-1957) and, after the transformation of the department into the 1st Clinic of Internal Diseases of the 2nd Central Clinical Hospital of the Military Medical Academy, Professor Stanisław Bober (1958-1970). During my time there I became a specialist in internal diseases, and in 1961 I defended my doctoral dissertation.

With my habilitation thesis in mind, I started research into the dynamics of the circulatory system in pregnant
women, which was not supported by the head of the clinic. That is why I was glad when in 1964 I was transferred to the newly opened hospital at Szaserów Street, where I held the position of head of the 3rd Clinical Department of Internal Diseases. Following the advice of Prof. Dymitr Aleksandrow, the commandant of the newly established Post-Graduate Education Institute of the Military Medical Academy, I took up radio telemetry and radiotelecardiography. On the basis of this research, in 1968, I defended my habilitation thesis. In 1974 I became an associate professor and in November 1980 a full professor. I became a member of the Central Committee for Degrees and Titles (CKK).

The management was constantly changing, just like the underlying ideas of the organization of the military health services. In 1983, the idea was to divorce the hospital from the Post-Graduate Education Centre of the Military Medical Academy. In May, several weeks after the briefing of the executive staff in Olsztyn, where the rumors were publicly denied, I learned from a senior officer at the Department of Finance of the Ministry of National Defence that there would be two independent facilities: Central Clinical Military Hospital (CWSK) and the Post-Graduate Education Centre of the Military Medical Academy. Since I could not have been in these two organizational units at the same time, I immediately resigned from my position as commandant of the Centre and remained the head of the 3rd Clinic of Internal Diseases, at the Institute of Internal Medicine. This decision was driven by the conviction that my primary place of work was beside the patient's bed and not at a desk.

When somebody asked me why, I replied with another question: Who will ensure the “clinical” character of the Central Clinical Military Hospital after its detachment from the Post-Graduate Education Centre of the Military Medical Academy? They came up with the monstrous abbreviation of “CWSK CKP WAM”, which was supposed to guarantee this “clinical” character. It was then that I understood that the end of the Centre was near. And I was not mistaken.

I would also like to add a few words in memory of Gen. Prof. Boleslaw Szarecki (1874-1960), to whom I provided medical care in the final years of his life. The General resigned from his position of chief of the Health Services of the Ministry of National Defence in uniform, and he remained a surgical adviser to his successor. He had a representative, so to say, in the management, Col. Tadeusz Rożniatowski PhD, who frequently visited the General at 28 Nowowiejska Street, where he read the most interesting papers on surgical procedures to the General. Col. Aleksander Śniagurowicz MD, PhD, head of the health care service, also kept in touch with the General.

At first, I visited the General together with Prof. Fejgin, then with his successor, Prof. Kędra, the head of the department of internal diseases and the chief specialist in internal medicine in the Polish Army. A year before his death, General Szarecki invited me to his place. His wife, Maria, opened the door and said: “Boleslaw is waiting, there's another reason for the visit.”

The General said to me: “My dear Colleague” – he said slowly, with a soft and gentle voice. “Please forgive an old man. Perhaps I'm vain but I have a favor to ask of you: I'd like you to help me live for another year because I have four anniversaries coming up: the anniversary of my military service, my professorship, my marriage, and one more.”

It was fortunate that the General could celebrate his jubilees. The army organized a beautiful celebration at the Officers Club at Madaliński Street. General Szarecki arrived wearing his ceremonial uniform and was accompanied by his wife. The army was represented by General Jerzy Bordziłowski, who presented General Szarecki with a beautiful painting on behalf of the ministry.

The General delivered a speech without notes or any special preparations. In simple, straightforward and warm words, he expressed his gratitude to the management of the Ministry of National Defence for having remembered his anniversaries, which, as the General pointed out, are delightful especially for an old soldier.

Let me conclude these reminiscences with an old and a well-tried maxim addressed to the entrants to military medicine: “Those who have not smelled the odor of soldier’s footwraps will never make good military physicians”.

Figure 2. Prof. Sylwester Czaplicki delivering a lecture after being granted an honorary doctorate at the Gen. Prof. Boleslaw Szarecki Military Academy of Medicine in Łódź, 1998

In memory of Wojciech Silny, professor of medicine (1942-2015)


Our dearest colleague, Prof. Wojciech Silny, MD PhD, a prominent Polish physician, a dermatology and allergology specialist, died suddenly on 29 September 2015.

Professor Silny had many friends among military physicians, and on many occasions I could bear witness to his true appreciation and admiration for military medicine and military healthcare. He participated in a number of our national initiatives, including meetings and conferences of military dermatologists and allergologists. He also contributed to drawing up guidelines, conducting scientific research as well as carrying out educational and publishing activities. While doing so, he was always extremely kind, friendly and conscientious. His great sense of humor made him the life and soul of many meetings, many of which are still remembered.

He was born on 12 July 1942 in Chobielin in the Kujawsko-Pomorskie Province. He became professionally involved with the Greater Poland Region, and especially with Poznań, where he began his medical education, professional career and scientific activities, working for the Department of Normal Anatomy, and then for the Dermatology Clinic at the Medical University in Poznań. In 1984, he received his habilitation degree in medical sciences (which is a step higher than PhD in the Polish degree system); in 1985 he was appointed an assistant professor, and in 1997 he was conferred the degree of professor of medicine. In 2001, the Minister of Health appointed him a full professor at the Poznań University of Medical Sciences.

In 1992, he received an allergology specialist title, having passed his examination with distinctions. In 1994, he set up an Allergic Diseases Diagnostics Centre at the 2nd Medical Faculty of the Poznań University of Medical Sciences. While managing the Centre, he conducted specialist training for allergologists, along with diagnostic and scientific studies, also rendering healthcare services in the field of diagnosing allergic diseases.

In 2001, following Prof. Jerzy Bowszyc's retirement, he was appointed head of the Dermatology Department and Clinic at the Poznań University of Medical Sciences, opening the last, but very fruitful, chapter in his activity, and in doing so not only contributing to Poznań dermatology and allergology, but also earning national and international recognition. He promoted a number of doctors, acted as the patron for several habilitation theses, and supervised specialization courses for several dozen physicians. He was the author and co-author of 213 papers dealing with dermatology, venereology and allergology, as well as a co-author of numerous books in the field of allergology including “Atopic dermatitis”, “A lexicon of allergic skin diseases and drug reactions”, and “Skin symptoms of drug hypersensitivity”. He also translated and edited the Polish issue of the “Dermatology” textbook and atlas by Rassner and the “Allergology” textbook by Mygind et al. Along with the numerous functions he fulfilled in the Polish Dermatological Association, in 1988-2002 he was a member of the Management Board of the Polish Society of Allergology (in 1988-1995 the president of the Poznań branch, and from 2000 the president of the National Allergological Section of the Polish Dermatological Association). He twice organized training for members of the Allergological Section of the Polish Dermatological Association in Hurghada (Egypt), attended by several prominent allergologists and military healthcare representatives, which contributed to the integration of both scientific circles. He was a renowned
speaker at national allergological congresses and symposia. In 1995-2000, he acted as a regional, and then provincial, specialist for allergology in the Wielkopolskie Region. He was an active member of various expert groups of the Polish Society of Allergology, in charge of developing standpoints, and the national consultant's team in the field of allergology, as well as taking part in developing allergology standards.

In 2001, he became the editor-in-chief of the “Postępy Dermatologii i Alergologii” [Progress in dermatology and allergology] quarterly, the official magazine of the Allergological Section of the Polish Dermatological Association, which through his efforts gained international recognition and was granted the Impact Factor. This magazine was always open to military physicians, and until his last days, Professor Silny managed the magazine in a competent and passionate way, especially after retiring. The final editing and the excellent development of the twelve volumes of "Chronical of the Dermatology Department and Clinic of the Poznań University of Medical Sciences 1922-2012", issued by the Termedia publishing house, was one of his most precious, and - as it turned out - last initiatives.

Let me now share a few private reflections. I considered Wojciech as one of my close medical friends, although our views sometimes differed. We used to have disputes, which we eventually were able to compromise by meeting half way. Wojciech was a charismatic and extraordinary person, full of positive personal qualities. His authority and standing in the dermatological and allergological circles contributed greatly to the integration of the Polish allergologists’ environment. He was well aware of how important allergology was for dermatology, and how greatly dermatologists contributed to the shaping of the contemporary image of allergology. As I have already said, his direct attitude to people, coupled with an unusual sense of humor, made Wojciech an appreciated member of various groups and a welcome speaker at conferences and symposia. He created that special atmosphere that enables people to make work and relaxation pleasant. He was also ambitious and reliable, expecting much from other people and from himself. He was inclined to firmly defend his views even though sometimes this might make him look difficult to get on with. However, his persistence was often justified. He found negligence unacceptable, taking due care of the rational image of contemporary medicine, including especially dermatology and allergology. When it came to performing the duties of a national consultant, he was one to count on. He stressed the role of his tutors and really cared for them, just as he did for his employees, and in particular for their scientific and professional development. He made much effort to pursue the impressive modernization and reorganization of the Poznań-based Dermatology Clinic, which paved the way for its further dynamic growth.

Wojciech earned the titles of prominent physician, scientist, dermatology specialist and allergologist a long time ago. While still seemingly fighting fit, he died suddenly, much too early. Two weeks before his death, I had a chance to meet him in Bydgoszcz, recalling the good old times in a friendly atmosphere and listening to his reflections and ideas about the life of a retired professor. He had very inspiring plans and wished to act further for the benefit of dermatology and allergology.

A few days after his death, on 7 October 2015, with the feeling of deep grief and sorrow, we accompanied Professor Wojciech Silny on his last road. His body was buried in the Junikowo cemetery in Poznań.

His death was a huge loss for us, and he will be certainly missed.

Prof. Jerzy Kruszewski, MD PhD
Allergy, asthma, and rheumatic diseases - common problems for allergists, pediatricians, internists and rheumatologists. Report from the civil-military conference in Kielce, 24 October 2015

Alergia, astma, choroby reumatyczne wspólne problemy alergologa, pediatry, internisty i reumatologa. Sprawozdanie z konferencji cywilno-wojskowej, Kielce 24.10.2015

Grażyna Sławeta
Allergology Clinic in Starachowice; head: Sebastian Petrykowski

Delivered: 30/11/2015
Accepted for print: 01/12/2015
No conflicts of interest were declared.
Mil. Phys., 2016; 94 (1): 118-120
Copyright by the Military Institute of Medicine

Corresponding author
Grażyna Sławeta MD, PhD
Allergology Clinic
70 Radomska St. 27-200 Starachowice
telephone: +48600 996033
e-mail: gslaweta@poczta.onet.pl

The Świętokrzyska Medical Chamber and its Commission for Education and Science, together with local consultants in the field of allergy and pediatrics in Świętokrzyskie province, periodically organize training conferences that generate a very good opinion from the doctors who attend. As this year was the 10th conference it had the nature of a jubilee, and, as in previous years, a number of esteemed lecturers nationally were invited, including Professor Barbara Rogala of the Medical University of Silesia, and Professors Jerzy Kruszewski and Witold Tłustochowicz (national consultant in the field of rheumatology) from the Military Institute of Medicine in Warsaw. Military lecturers had already participated in previous conferences and gained recognition; therefore we wanted them to participate in this year's conference as well. Lectures were also given by doctors from the Świętokrzyskie province: Grazyna Sławeta PhD and Zbigniew Guzera PhD.

The lectures had an interdisciplinary character. Doctor Grazyna Sławeta discussed the problem of cutaneous manifestations of collagenosis and problems of allergic reactions that may be relevant from a rheumatologist's point of view, focusing on the new and current problem of hypersensitivity to biological drugs.

Professor Witold Tłustochowicz presented broadly the issues of diagnosis and treatment of vasculitis, emphasizing his position in an important problem in practice, namely that of which specialist to choose, as well as when and how to care for the sick person.

Doctor Zbigniew Guzera discussed the possibilities of modern immunodiagnosis in connective tissue diseases, including their practical usability and accessibility in the Świętokrzyskie region.

Professor Barbara Rogala gave a general discussion on safety and the possible side effects of asthma steroid therapies used these days, emphasizing that the risks are minimal, especially with regard to steroid use before the introduction of the inhaled form.

Finally, Professor Jerzy Kruszewski covered important practical principles in the use of adrenaline, which is a drug that has been known for a long time now, and which has become the basis for the treatment of anaphylaxis as well as being available for self-medication.
It follows that the interdisciplinary problems and issues discussed during the conference were interesting for physicians from different specialties because several dozen doctors from around the Świętokrzyskie province participated, including allergists, pediatricians, rheumatologists, general practitioners and pulmonologists. They had an opportunity to ask the lecturers questions, to discuss and develop topics of interest to them, as well as to investigate a variety of practical problems.

Fellow doctors participating in the conference agreed that the training was of high quality and practical, and that the acquired knowledge would be useful for them in their daily work.