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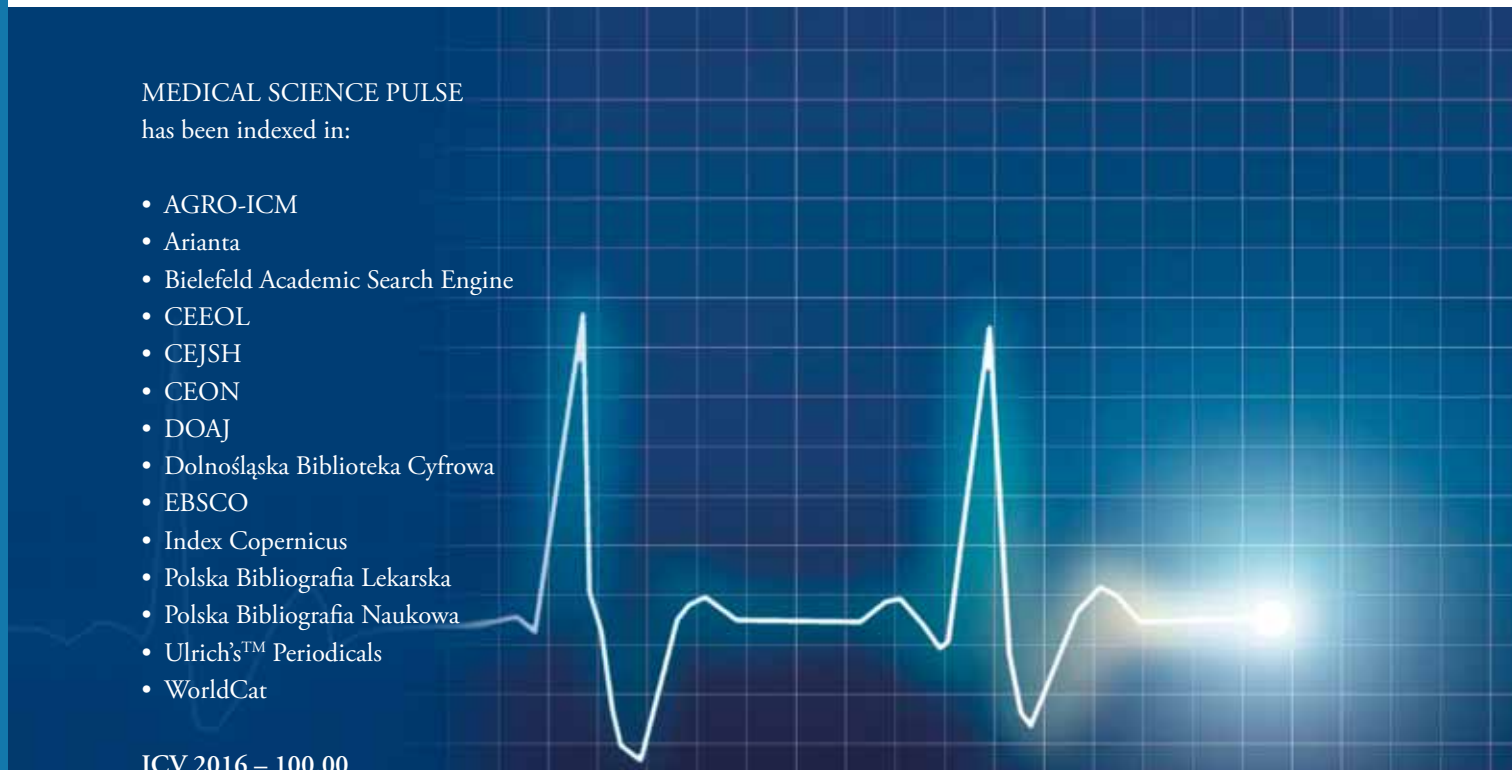

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Ladies and Gentlemen, Faculty, Graduates and Students of Universities, Readers and Enthusiasts of *Medical Science Pulse*!

The first issue of the scientific quarterly *Medical Science Pulse* was released on 31 March 2012 under the title *Higher School's Pulse*, a continuation of the title of the informational journal of the Opole Medical School, published since 2007. This is probably the only such example in Poland of a university newspaper that has been transformed successfully into a peer-reviewed scientific journal, covering the subject matter of medical, health and physical education sciences.

Back then, as a handful of enthusiasts who started working on building the scientific quality of the quarterly on the already crowded market of medical journals, we have achieved a great deal: high scores in the international ranking of the company Index Copernicus – ICV 2016: 100, a 6-point entry on the B list of journals of the Ministry of Science and Higher Education, professional indexation in numerous data bases of scientific journals, both Polish and foreign, and a professional website in English. Moreover, we have financial publishing stability, specific goals and a mission, standardized reviewing and processes for handling ethical issues and clear authorizations, in addition to high editorial standards. All the manuscripts submitted are sent to two independent experts for a scientific evaluation and the Editorial Board's final assessment of each article is based on criteria developed by the COPE. Usually, a manuscript is published about six months from the date of first submission.

The Editorial Board pays particular attention to the internationalization of the journal; hence we have a large group of prominent scientists from the Scientific Committee, representing various European and American universities and scientific institutions, together with an expanding group of domestic and foreign reviewers and authors applying to publish research, even from distant countries such as Egypt, India and Iraq.

Since 2018, *Medical Science Pulse* has been published exclusively in English – a necessary condition for popularizing scientific content in the field of medical sciences globally – allowing for better communication with authors, readers and reviewers through the means of the editorial and publishing website: medicalsciencepulse.com. All the articles carry a DOI (Digital Object Identifier) number, which is a standard identifier for electronic documents and more stable than URLs. All the papers have been approved for publication using a Creative Commons license, in the Open Access system, free of charge.

Medical Science Pulse is often the first-choice journal for young scientists, including students and graduates of medical universities, who are just learning how to have their research published. The editors of the quarterly support them with the professional development of manuscripts, through close cooperation with a thematic and language editor, who is a native speaker and a medical professional.

We would particularly like to thank the Authors and Readers for their cooperation with our Quarterly and their willingness to publish, read and use the results of research in scientific environments. We are also grateful to the Members of the Scientific Committee and to the Reviewers, Editorial Board and University Authorities for their contribution to the development of the journal, their continued support and the experience they share every day in relation to some demanding editorial and publishing activities.

Furthermore, we are happy to welcome the new members of the Scientific Committee: Prof. Giovanni Barassi MD, PhD, Prof. Rosa Grazia Bellona and Prof. Raoul Saggini from the University of Chieti-Pescara in Italy and two prominent scholars from Japan, Prof. Masumi Inoue, Department of Cell and Systems Physiology, School of Medicine, University of Occupational and Environmental Health in Kitakyushu and Prof. Yasumasa Okada from Clinical Research Center and Division of Internal Medicine Murayama Medical Center in Tokyo. We also warmly welcome the new thematic editor Assoc. Prof. Aelita Skarbalienė, MD from Klaipeda University in Lithuania. Thank you for your willingness to act within the group of the *Medical Science Pulse*: for us it is proof that publishing the only peer-reviewed medical scientific journal in the academic region of Opole is worth every effort.

It is you – the Authors and Readers, Reviewers, Members of the Scientific Committee, Editors and the Editorial Board – who guarantee the reliability and high standard of *Medical Science Pulse*!

We hope that all the changes made over the last two years will allow *Medical Science Pulse* to achieve greater individualization and better identification within the academic market for periodicals, as well as for the specialization of the title in the area of research presented.

In this issue, we would like to emphasize the association of the journal with the 5th International Medical Science Pulse Conference: Interdisciplinary Science and Research, Opole, 22-23 May 2018.

This is another great achievement for the editors of the Quarterly, a cyclical organization – since 2014 – an international conference on conducting scientific research, scientific publishing, scientific journals publishing, obtaining scientific projects and communication within an international science environment. We are happy that among the large number of participants in this year's Conference we have many trusted friends whose papers have already been published in our quarterly. The outstanding Prof. Christos Lionis is at the forefront, along with new guests and world-class scholars such as Prof. Jadwiga Giebultowicz, who has collaborated with the 2017 Nobel Prize Laureate, Prof. Jeffrey C. Hall. We strongly recommend reading their publications.

In issue 1/18, we pay special attention to the Opinion Papers section, in which we present works on: *The challenging path to establish general practice in an academic environment – the case of the Czech Republic*, *Navigare necesse est! Research to understand our body and soul, to heal the patients, to find ourselves*, *Experiences of a Slovak PhD pioneer* and original articles that address current and interesting issues regarding the *The benefits of interdisciplinary team work: my research experience on lifestyle choices*, *Recent advances in computational chemistry for identification of ligands for biological receptors: interdisciplinary aspects*, *Current status of cutaneous leishmaniasis in some Iraqi Provinces: A cross-sectional study in 2015*. In the section devoted to review articles, we publish papers on: *Do we need more training for interdisciplinary and interprofessional collaboration prior to implementing any primary care research action?*, *The Value of Interdisciplinary Research: Lessons from the 2017 Nobel Prize in Chronobiology*, *Scientific writing for the biomedical science*s, *Airway management – a review of current methods, guidelines and equipment*.

We invite you to send the results of research projects, case reports and reviews through the section designated for authors: https://medicalsciencepulse.com/resources/html/cms/DEPOSITSMANUSCRIPT.

We invite you to cooperate further! Our mission is the continuous improvement and internationalization of an interdisciplinary platform for the exchange of research, information, ideas and experience in the field of medicine and related sciences. Having such a devoted group of authors, readers and supporters of *Medical Science Pulse*, we look forward to the scientific future of the Quarterly. We are ready for new successes!

The next issue is scheduled for release at the beginning of July 2018. We encourage you to visit our website today and read about the new section for paper publication "Ahead of print" (www.medicalsciencepulse.com)!

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Original papers

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THE BENEFITS OF INTERDISCIPLINARY TEAM WORK: MY RESEARCH EXPERIENCE ON LIFESTYLE CHOICES

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A – study design, **B** – data collection, **C** – statistical analysis, **D** – interpretation of data, **E** – manuscript preparation, **F** – literature review, **G** – sourcing of funding

ABSTRACT

Background: A common international research area is being created as a result of linked activities of research centres.

Aim of the study: To implement an interdisciplinary approach based on the example of a pilot study of lifestyle and identify connections between physical activity levels (PA), health-related behaviours, and the locus of health control among students.

Material and methods: The research was carried out using 294 students of human sciences (235 females and 59 males) aged 18-24. A diagnostic survey method was chosen using the International Physical Activity Questionnaire (IPAQ), Health-Related Behaviour Inventory (HBI) and Health Locus of Control Scale (MHLC).

Results: Total PA was assessed at 3829.3 MET-min/week. The dominant types of activities were walking (1245 MET-min/week) and moderate PA (1254 MET-min/week). Higher values in intensive and moderate efforts were reported among the male students, while women reported higher values in walking. The general severity index HBI is 72-93 points. There were no significant gender-related differences regarding the general indicator (except for the increased frequency of low health-related behaviours among females). Respondents mostly presented with internal locus of control with influence of others being reported less frequently, and accident locus of control least frequently. The analysis revealed a correlation between the internal placement of MHLC and PA among men ($r=0.226$, $p<0.01$) and individual HBI indices among women.

Conclusions: Most young people present a sufficient level of PA, desirable HBI, and, to a large extent, the internal locus of MHLC. The participants had a greater sense of responsibility for their own health. Females, when deciding on a lifestyle, are more easily influenced by other people. It is necessary to conduct interdisciplinary group work for comparative research in order to create educational and preventive programs addressing identified lifestyle abnormalities.

KEYWORDS: group work, physical activity, health behaviours, students

Background

Complex tasks and projects that require interdisciplinary knowledge, diverse skills, and extensive experience can be implemented by research teams. The development of information and communication technology (ICT) has caused the emergence of new forms of organization and management of work in science [1, 2]. Virtual teams are groups that perform collective work which require joint efforts and generate positive synergy. Since the participants often do not have a direct contact, they communicate through the ICT sector. This current investigation is focused on virtual collaborative research activities uniting researchers from different parts of Europe. The intent of this example of cooperation between a group of scientists from Poland and Belarus using internet platforms is designed to incite cooperation among other centres working in the field of broadly understood health promotion and encourage an interdisciplinary approach to lifestyle education.

Effective implementation of entrusted interdisciplinary tasks requires a virtual team to meet certain specific requirements [3]:

1. A common goal / task (and its sense) as well as performance indicators.
2. Involvement in the task achievement (the goal itself must be motivating).
3. An atmosphere of trust and openness.
4. Open and honest exchange of information, opinions, and ideas.
5. The sense of attachment to the team.
6. Expertise (knowledge, experience, and skills).

The research team creates conditions for building interpersonal relations based on mutual acceptance, sympathy, and trust among representatives of various specialties [4,5]. Network organization also requires a new style of management and a new form of cooperation between scientists. Similarity of goals, at least in part, is an essential component for successful connection between virtual research teams. The stages of the networking process include participant selection and implementation of connections among those selected. In other words, the launch of the network operation is most often based on written agreements, or contracts, with individual members [6]. In our case, networks were contracted between the following universities: Yanka Kupala University in Grodno, Belarus represented by the Department of Sports Medicine and Rehabilitation, and the University of Medical Science in Bialystok, Poland.

As a result of the network activities of research centres, a common international research area is being created, and the actions of scientists are becoming, on the one hand, more flexible, dispersed, and focused on specific tasks. On the other hand, they are cheap and implemented as quickly as possible. The reconstruction of knowledge as well as the process through which this knowledge is transferred, is of equal importance. Conducting research in virtual teams allows universities to reduce costs while ensuring high quality and timeliness, which, in the modern era of seeking minimization of hurdles, is very important. An example here is the study of the connections between the level of physical activity, health-related behaviours, and the locus of health control among active students as an interdisciplinary problem in public health.

Aim of the study

The main objective of the research was to find a relation between the level of physical activity, pro-health attitudes, and generalized expectations across three dimensions of the locus of health control among Grodno male and female students.

Specific objectives:

- assessment of the physical activity among respondents.
- assessment of student health-related behaviours (eating habits, preventive behaviours, positive mental attitudes, health practices).
- assessment of generalized expectations across three dimensions of the locus of health control: internal (belief that control over one's health depends on the person), the influence of others (belief that the state of health is the effect of others) and accident (health condition depends on an accident or other external factors).

Material and methods

Data collection instruments and operational definitions

The assessment of the level of all studied characteristics of the population group was made using the following questionnaire techniques:

1. The International Physical Activity Questionnaire (IPAQ), whose Polish version has been officially registered (the Belarusian one is in the process of registration), expresses physical activity in MET-min units / week, which allows easy classification of respondents into one of three categories of activity: insufficient, sufficient, or high [7].
2. The Standardized Health-Related Behaviour Inventory (HBI), according to Juczyński, contains 24 statements describing various types of health-related behaviours, determines the general index of the severity of health behaviours, and determines the severity of these four categories of behaviours: appropriate nutrition (mainly taking into account the type of food consumed), preventive behaviours (regarding compliance with health recommendations and obtaining information on health and disease), health practices (everyday habits regarding sleep, rest and physical activity), and positive mental attitude (avoidance or coping with stress) [8].
3. The Standardized Multidimensional Health Locus of Control Scale (MHLC) contains 18 statements about generalized expectations across three dimensions of the locus of health control depending on both internal and external factors [9].

Study location and respondents

A pilot study was conducted by the authors in October 2017 among 294 students of the University of Grodno, Belarus. The respondents consisted of 235 women and 59 men, aged 18-24. Female respondents outnumbered male respondents (79.9% women versus 20.1% men), which reflects the students' gender balance at the faculties in each university and guarantees the consistency between the group of respondents and the population of students studying at these universities. All respondents were first-stage students. The age of the respondents was presented as median with minimal and maximal ranges on account of non-par-

ametric distribution of variables. Age [median] (min-max, interquartile range - IQR) - [20] (18-24, 19-23), among men [21] (18-24, 19-24), among women [20] (18-24, 20-22).

Statistical analysis

The results of the study were exposed to statistical analysis. Descriptive statistics including mean, standard deviation, median, minimum, maximum, and IQR were calculated. The non-parametric tests Mann-Whitney U test and Chi-square test were also applied. The critical level of significance for all tests was $p<0.05$. Statistical analysis was performed using the statistical software STATISTICA 10.0.

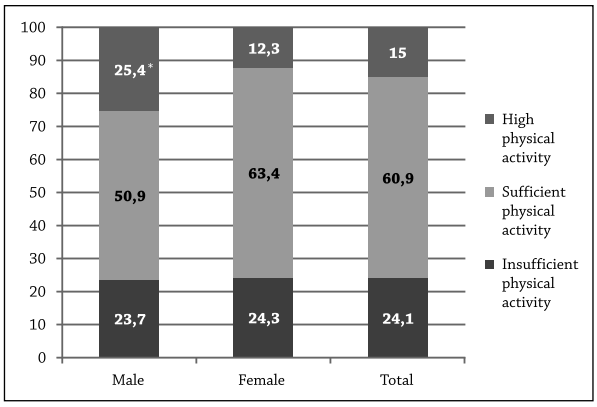
The research was carried out after obtaining a positive opinion of the Bioethics Committee of the University of Yanka Kupala in Grodno (3/44 30-11-2017) and was also conducted in accordance with the requirements of the *Helsinki Declaration*. Participation in the study was voluntary and anonymous. Each person was informed about the purpose of the study and the use of the results obtained.

Results

Physical activity

The long version of the International Physical Activity Questionnaire (IPAQ) was used in the research to determine 3 levels of physical activity: high (>1500 MET min/week and at least 3 days a week with intensive efforts, or over 3000 MET min/week), sufficient (600-1500 MET min / week), and insufficient (<600 MET min/week) [7, 10]. MET is a metabolic equivalent that corresponds to the oxygen consumption during the resting metabolism. According to scientific findings, 1 MET equals 3.5ml O_2/kg body weight per minute. Intense physical effort is equal to the consumption of 8 MET every minute within its duration, moderate effort is equal to 4 MET, and walking (march, fast walking) equals 3.3 MET. The calculation of the total energy release, i.e. the identification of the level of physical activity of the subject, was made by multiplying the frequency and duration of the effort by the intensity as expressed in MET units. The total physical activity was assessed at the level of 3829.3 MET-min./ times regarding physical efforts of intense, moderate pace and walking, and proved not to differ among men 3906 MET-min/week and women with 3807 MET-min/ week correspondingly. The dominant types of activity were walking (1245 MET-min/week) and moderate physical activity (1254 MET-min/ week).

Men had higher values in intensive and moderate efforts, while women had marginally higher values in terms of walking. Statistically significant variation according to the Mann-Whitney U test in favour of male subjects was found only in relation to intense physical activity (Z-2.72, $p<0.005$). Every fourth male (25.4%) was characterized by high activity, but the percentage was only 12.3% among females. The Pearson Chi-square test showed a statistically significant ($p<0.05$) variation in a high level of physical activity in relation to the gender of students (Fig. 1).



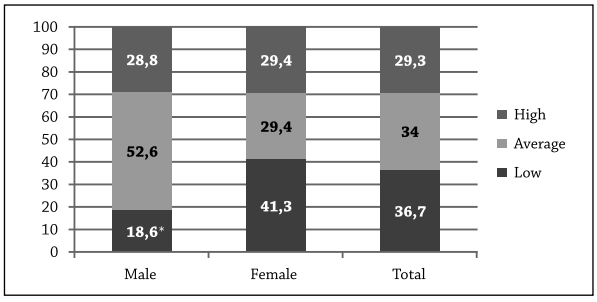
*Pearson's chi-squared test ($\chi 2=6.61$, $p=0.03$)

Figure 1. Types of physical activity of students (including gender)

Health behaviours

In the further part of the study, a comparison of health behaviours in individual categories of the Standardized Health-Related Behaviour Inventory (HBI) according to Juczyński was made. The average number of points obtained by the respondents in the questionnaire was 81.5 (SD=14.2). The general indicator of the severity of health behaviours of respondents, measured by the HBI scale, appeared to be within the range of 72-93 points. The higher the score, the greater the severity of health behaviours declared (median 80 points).

108 participants of the survey obtained a low result in HBI, 100 - average, and 86 - high (almost one third of respondents in each group). The analysis of health behaviours depending on the *gender* variable, made it possible to conclude that there are no statistically significant differences in the general indicator of health behaviours and its components (apart from the representatives with low levels of health behaviours) (Fig. 2).



*Pearson's chi-squared test ($\chi 2=14.0$, $p<0.001$).

Figure 2. Types of students' health behaviours (including gender)

The severity of four categories of health behaviours presented in the description of the method was then calculated separately. The indicator was the average number of points and the median in each category (Tab. 1).

Table 1. Average results of the Standardized Health Behaviour Inventory (HBI) scale assessment in the group of surveyed students

HBI	Gender	M±SD	Median	Min	Max	Q1*	Q3*
Total score	Male	79.9±13.3	76.0	51.0	114.0	72.0	90.0
	Female	81.9±14.4	81.0	27.0	120.0	71.0	94.0
	Total	81.5±14.2	80.0	27.0	120.0	72.0	93.0
Appropriate eating habits	Male	3.19±0.66	3.0	1.8	4.8	2.8	3.7
	Female	3.24±0.78	3.3	1.0	5.0	2.7	3.8
	Total	3.24±0.76	3.17	1.0	5.0	2.67	3.83
Preventive behaviours	Male	3.38±0.74	3.3	1.5	5.0	3.0	3.8
	Female	3.59±0.79	3.7	1.0	5.0	3.0	4.2
	Total	3.55±0.78	3.5	1.0	5.0	3.0	4.17
Positive mental attitude	Male	3.46±0.70	3.3	2.3	5.0	3.0	4.0
	Female	3.58±0.73	3.5	1.0	5.0	3.0	4.2
	Total	3.55±0.73	3.5	1.0	5.0	3.0	4.0
Health-related practices	Male	3.28±0.62	3.2	2.0	4.7	3.0	3.7
	Female	3.24±0.68	3.2	1.2	5.0	2.8	3.7
	Total	3.25±0.67	3.17	1.17	5.0	2.53	3.67

* – Q1 can be thought of as a median in the lower half of the data, and Q3 can be thought of as a median for the upper half of data.

Analysing the research material, a low rate of health behaviours in the range of consumed food and health practices was found. Higher than medium index was declared across positive mental attitude and preventive behaviours variables.

Statistical significance was not found in case of the general indicator of health behaviours ($p > 0.05$) dependent on physical activity. There were no statistically significant differences in individual categories of health behaviours ($p>0.05$) depending on gender, with the exception of the category „preventive behaviour" where sufficient physical activity among women was found ($p<0.05$) (Tab. 2).

In many works it is stated that women lead healthier lifestyles than men. This statement was supported by the findings that the male students were less likely to practice positive health behaviours than were their female counterparts.

Health Control Locus

Respondents were asked to express their attitudes to the presented statements in the Multidimensional Health Locus of Control Scale (MHLC) [9, 11]. Concerning health, there are two types of control locus: internal - an individual's belief of being able to control his/her health, and external - conviction of the indi-

Table 2. Average respondents' results from the Standardized Health-Related Behaviour Inventory

Group	N	Health behaviour indicator	Appropriate eating habits	Preventive practices	Positive mental attitudes	Health-related practices
Insufficient physical activity						
Male	14	80.3±17.5	3.21±0.68	3.57±0.98	3.38±0.90	3.21±0.86
Female	57	82.8±13.9	3.22±0.71	3.61±0.76	3.68±0.72	3.28±0.65
Total	71	82.3±14.6	3.20±0.70	3.60±0.80	3.62±0.76	3.27±0.69
Sufficient physical activity						
Male	30	79.5±11.87	3.20±0.68	3.26±0.68*	3.47±0.61	3.32±0.55
Female	149	81.6±15.0	3.27±0.83	3.60±0.82	3.51±0.74	3.30±0.71
Total	179	81.5±14.5	3.26±0.80	3.54±0.80	3.51±0.72	3.27±0.68
High physical activity						
Male	15	80.3±12.5	3.16±0.62	3.46±0.63	3.51±0.68	3.26±0.50
Female	29	80.8±12.9	3.18±0.68	3.50±0.69	3.70±0.69	3.18±0.62
Total	44	80.6±12.6	3.17±0.65	3.48±0.67	3.64±0.68	3.14±0.58

* Differences in the categories of health behaviours ($p <0.05$) depending on gender.

vidual that his or her health condition is dependent on external factors. The calculation of the results was made separately for three dimensions of health control: internal control, influence of others, and the accident. By studying the same students with the MHLC scale, it was established that the respondents mostly presented internal health control dimension. The second most common response was the locus of control within the category of influence of others with the accident category appearing least often. Male students obtained a higher level of declared health behaviours ($p < 0.05$) than female students. Details are presented in Tab. 3.

The locus of health control in the category of influence of others positively correlates with the general assessment of health behaviours in both groups ($p<0.05$). Moreover, in the group of men, a positive correlation was also found with the locus of health control in the internal category ($p<0.001$).

The locus of health control in the category of influence of others positively correlates with the general assessment of health behaviours in both groups ($p<0.05$). Moreover, in the group of men, a positive correlation was also found with the locus of health control in the internal category ($p<0.001$).

Conducting group research according to the recommendations of the authors of the tool, the results were classified assuming the median was a border for the division of results into high and low thresholds in each of the three dimensions. Depending on the level of physical activity, the highest level was achieved by the internal locus of the control (26.98±4.77) with high physical activity and a significantly lesser level - 24.17±5.38 among students with insufficient physical activity.

The conducted analysis of the correlation between physical activity, the general indicator of health behaviours, and the locus of health control showed a statistically significant relationship between the internal locus of the control and physical activity, especially among men ($r=0.26$, $p<0.05$), and individual categories of the Standardized Health Behaviour Inventory among women ($p=0.03$) (Table 4). Among female students, the general level of declared health behaviours increased with an increase in the locus of the control in the category of influence of others ($p=0.003$) (prophylactic behaviour and positive psychological attitude).

It is possible that women often have a motive to improve their beauty, while chiefly the health aspect governs men [12]. On the other hand, the decrease in the locus of accident control among men is accompanied by the increase in the level of positive mental attitude ($r=-0.30$, $p=0.004$) as health behaviour.

Discussion

The lifestyle of contemporary societies is characterized by factors that are usually the cause of the occur-

Table 3. Interpretation of the Standardized Multidimensional Health Locus of Control Scale (MHLC) depending on the gender of the respondents

MHLC	Gender	M±SD	Median	Min	Max	Q1	Q3
Internal factors	Male	26.7±5.4	28	14	36	24	30
	Female	25.8±4.6	26	6	36	23	28
	Total	25.9±4.8	26	6	36	23	29
Influence of others	Male	24.6±7.1	24	6	36	20	30
	Female	23.0±6.0	24	6	36	19	27
	Total	23.3±6.3	24	6	36	19	28
Accident	Male	24.3±6.7	25	11	36	18	30
	Female	21.7±5.3	22	6	36	18	25
	Total	22.2±5.7	22	6	36	18	26

Table 4. Spearman's correlation coefficient in terms of physical activity, health behaviours and the locus of health control depending on gender

Gender	Variables MHLC	Physical activity	General indicator of the severity of health behaviours (sum)	Appropriate eating habits	Preventive behaviours	Positive mental attitude	Health-related habits
Male	Internal type	0.26*	-0.12	-0.08	-0.21	-0.05	-0.11
	Influence of others	0.07	0.09	0.14	0.06	0.12	-0.04
	Accident	0.09	-0.16	0.06	-0.19	-0.33*	-0.11
Female	Internal type	0.07	0.01	0.04	-0.01	-0.01	0.03
	Influence of others	-0.01	0.21*	0.12	0.27*	0.17*	0.13
	Accident	0.06	-0.09	-0.07	-0.04	-0.12	-0.03

* – Correlations are significant at $p < 0.05$.

rence of many abnormalities and illnesses (low level of physical activity, high level of stress, use of psychoactive substances). The point is likewise proven in cases studying youth. The conducted research shows unfavourable tendencies of the level of physical activity observed in the comparative assessment carried out in recent years [13, 14].

Physical activity is one of the important components of a lifestyle. Movement causes physiological reactions (physiological mechanisms) in the body. The main components of these mechanisms, according to Kasperczyk, are [15] effects on energy metabolism, increasing the adaptive (and working) capacity of the organism, information on the impact of physical activity, and a positive effect on the human psyche (reduction of stress level). Unfortunately, in recent years, according to Maszorek-Szymala and Kaźmierczak [16], the level of physical activity of young people has decreased. Baj-Korpak and others [12] note in studies of physical culture that 12 percent or more of young people do not take any physical activity during their free time. There is convincing experimental evidence that physical activity of moderate intensity prevents a wide range of physical and mental disorders and improves quality of life [17].

A review of research on physical activity conducted by Bergier showed that the current results do not allow for an objective assessment of physical activity even within the same social group, e.g. academic youth [10]. In fact, these results often seem to be overestimated. To avoid this, the authors of the article personally conducted studies on physical activity of students, students' pro-health attitudes, and students' generalized expectations across three dimensions of the locus of health control.

The International Physical Activity Questionnaire (IPAQ) was designed to compare country-specific surveys and their consequent use [18]. The basic English version of IPAQ has been used to develop and effectively utilize other language versions [19, 20]. The Russian version of IPAQ was used for the purposes of this study [21, 22].

Many factors determine the nature of physical activity. Sometimes it is difficult to determine to what extent they depend on certain objective conditions inducing the individual to express greater concern for his or her own health and lifestyle by undertaking pro-health activities [23]. Health behaviours are one of the categories of human behaviour that are part of lifestyle. These are both factors related to the social characteristics of the individual, as well as those that result from the nature of collective life. During the research on determinants of health behaviours among a group of students, the researchers tried to check how physical activity, health behaviours, and the locus of health control affect each other. Reviewing the available literature, the authors of the study did not find studies comparing the level of health behaviours, their determinants, and the level of physical activity among students. Studies available in scientific databases described specific behaviours, such as smoking or nutritional behaviours. The theory of Health Locus of Control indicates the existence of a relationship between the locus of the sense of control of one's own health and the performance of activities conducive to health [24].

Similar to the studies conducted by the group of physical education teachers Szczepańska-Kunder and Lipowski [25], men were characterized by the dominant internal locus of health control in comparison to women who were characterized by stronger health locus in terms of influence of others and accident. In the research on the impact of the locus of health control and the categories of HBI, Kurowska and Różańska stated that higher values of appropriate eating habits, preventive behaviours and positive mental attitude were demonstrated by respondents who obtained high results in health control of the internal dimension and the category of influence of others [26]. In general, it is believed that the internal locus of control is more beneficial because people who manifest dominance of internal control are more autonomous in decision making process, more often engage in pro-health activities, and have a greater sense of responsibility for their health. The internal sense of control is often related to the desire to improve and maintain health, which is why the result of this scale correlates with exercise of preventive behaviours [27]. A study by Nowicki and co-workers, 2017 [9] shows that the internal locus of health control correlates positively with the level of health behaviours and all categories across HBI among representatives of non-medical professions and with a positive mental attitude, and categories of preventive behaviours and health practices among representatives of medical professions.

Conclusions

In summary, declarations regarding the key role of physical activity, health behaviours and the locus of health control build a comprehensive picture of students, allow for a broader understanding of the context of choices made, and provide the possibility of modifying individual behaviour patterns. The youth covered by the study mostly presented a desirable level of physical activity, both mediocre and desirable health behaviours and, to a large extent, the internal locus of health control. The subjects of the study had a greater sense of responsibility for their own health, but women were more likely to be influenced by other people when shaping their lifestyle. It becomes necessary to investigate the causes of such behaviour to create remedial programs which are meant to address identified lifestyle abnormalities. The significant role should be attributed to conducting comparative research, for the benefit of which both interdisciplinary group works, proposals of educational and prophylactic programs and health education aimed at young people are used.

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RECENT ADVANCES IN COMPUTATIONAL CHEMISTRY FOR IDENTIFICATION OF LIGANDS FOR BIOLOGICAL RECEPTORS: INTERDISCIPLINARY ASPECTS

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A – study design, **B** – data collection, **C** – statistical analysis, **D** – interpretation of data, **E** – manuscript preparation, **F** – literature review, **G** – sourcing of funding

ABSTRACT

Background: Computational (*in silico*) methods, such as quantitative structure-activity relationships (QSARs) are already well recognized and used in many screening programs related to environmental, industrial and medical chemistry. The main idea of the QSAR is that there is a relationship between molecular structure and ultimate biological effect caused by a chemical compound. In this respect the approach could be used successfully for prediction of various biological endpoints caused by chemical compounds including receptor binding affinity.

Aim of the study: In the current study the capabilities for structure-activity modelling incorporated in non-commercial software tool have been employed for investigating the binding effect of xenobiotics toward estrogen and human pregnane X receptor.

Material and methods: The analysis was performed by making use of the non-commercial software platform QSAR Toolbox. This system allows application of a set of built-in models for different biological effects, and also allows incorporation of new models for other endpoints.

Results: Two models have been applied for predicting the binding effect toward estrogen and human pregnane X receptors of a large number of chemicals collected in a single database of high practical concern. The results show that there are many chemicals which are able to bind the investigated receptors. Since those chemicals are encountered in the environment, they could be considered as potential threat for society.

Conclusions: The obtained results could be used as initial step for further experimental testing of those chemicals in order to confirm their potential to harm biological systems in the body.

KEYWORDS: QSAR, computational chemistry, nuclear receptors, human health

Background

Nuclear receptors (NRs) are a superfamily of ligand-dependent transcription factors that mediate the effects of hormones and other endogenous ligands to regulate the expression of specific genes. Members of the NR superfamily include receptors for various steroid hormones (estrogen, androgen, progesterone, and several corticosteroids), retinoic acid, thyroid hormones, vitamin D, and dietary lipids (the peroxisome proliferator activated receptor (PPAR)). A large number of 'orphan' NRs (e.g. pregnane X receptor, farnesoid X receptor and liver X receptor) have also been identified whose cognate ligands are still unknown [1].

Many environmental chemicals can interfere with NRs, resulting in adverse biological effects. For example, in recent years, various agricultural, industrial, and household chemicals have been shown to directly or indirectly interfere with the endocrine system of wildlife species and humans [2]. These chemicals called endocrine disrupting chemicals (EDCs) have the ability to mimic or inhibit the endogenous hormones such as estrogens and androgens. In this respect they have a potential to affect development and/or reproductive function in wildlife and humans [3].

Computational tools for early identification of potential ligands toward receptor macromolecules are becoming increasingly useful and accurate and are now used extensively by computational chemists in the field of environmental, industrial, and medicinal chemistry (Figure 1).

The Quantitative Structure-Activity Relationship (QSAR) method is now becoming an essential part of modern drug design, resulting in cost savings by reducing the laboratory resources needed and the time

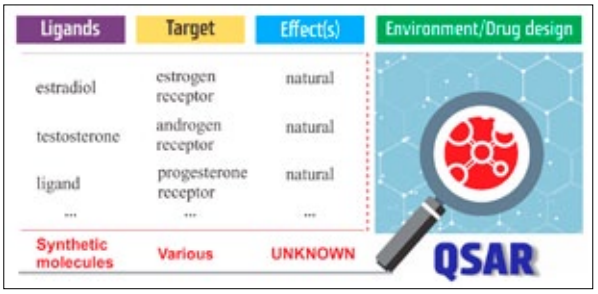

Figure 1. The role of QSAR for the identification of chemicals which are potential ligands for endogenous receptors.

required to create and investigate new compounds. QSAR is based on the concept that the differences observed in the biological activity of a set of compounds can be quantitatively correlated with differences in their structural or physicochemical properties by means of statistical or mathematical tools [4].

Recent findings have proven QSAR's value in predicting the binding effect of organic molecules toward many receptors including estrogen [5] and human pregnane X (PXR) receptors [6]. However, it should be pointed out that each model has its own limitations of applicability as a result of limited experimental data used for model development. To overcome this limitation researchers are encouraged to improve their models constantly by adding new experimental data. Another important question concerning the usage of models is that they are only available commercially, or require high level programming skills in order to be applied. Recently, authorities such as European Chemical Agency (ECHA) [7] and the Organisation for Economic Co-operation and Development (OECD) [8] have joined efforts to promote and support development of non-commercial tools for chemical risk assessment called the *OECD QSAR Toolbox* [9]. Currently, this tool is accepted and used in many companies, organizations, and national authorities for in silico predictions of different biological endpoints, including receptor mediated effects. An added advantage for users of OECD QSAR TOOLBOX is the ability to manually incorporate new models. Therefore, this software can be used for prediction of any biological endpoint if experimental data is available and the model is in agreement with OECD principles for reliability [10].

In this study, new model for identification of potential ligands toward human pregnane X (PXR) receptor was applied for screening of a large chemical database. From the same database chemicals with possible estrogenic effect were identified by making use of built-in model for this effect in the OECD QSAR Toolbox.

Material and methods

OECD QSAR Toolbox

This software tool, created and maintained by the Laboratory of mathematical chemistry, is specially designated for chemical risk assessment, [11]. A key part of this system is the ability to categorize chemicals, which allows for the grouping of chemical substances into categories. These categories of substances possess similar physicochemical, toxicological, and ecotoxicological properties, they behave similarly in environmental and occupational surroundings, and they can have similar chemical structures. An important advantage of the system is the large number of built-in models (profilers) for different biological/toxic endpoints. Each profile consists of a set of rules related to specific or general criteria associated to the respective endpoint.

The model for identification of estrogen receptor binders requires only chemical structure information describing the two-dimensional structure of molecules as an input. According to the classification scheme, cyclic chemical structures weighting less than 500 Daltons (Da) and bearing a hydroxyl (OH) and/or amino (NH_2) group are considered as binders. On the other hand, a chemical is considered as a non-binder if it does not satisfy these rules or if its OH or NH_2 groups are impaired by ortho di-substitutions [12]. In addition, each rule is associated with predefined binding potency which corresponds to very strong, strong, moderate or weak binding effects.

QSAR model for Pregnane X receptor

The activation of human pregnane X receptor (hPXR) regulate the expression of metabolizing enzymes such as cytochrome P450 (CYP3A4, CYP2B6 and CYP2C8/9) and glutathione-S-transferases, as well as important drug transporters (P-glycoprotein, multidrug resistance protein as well as others) [13]. Because the CYP enzymes metabolize the majority of clinically important drugs, inadvertent upregulation by hPXR agonists may increase the metabolism and excretion of co-administered therapeutic agents and cause undesirable drug–drug interactions or the generation of toxic levels of a drug metabolite. Hence, the activation of hPXR has the potential to initiate a broad spectrum of adverse effects, and in this respect identification of hPXR ligands is important information for evaluating health risk of drugs and environmental chemicals. As a result of analysis of training data, a set of eleven rules associated with specific chemical categories related to hPXR activators has been proposed [14].

OECD HPV database

The database consists of 4843 chemicals compiled based upon submissions from member countries including the European Union's high production volume (HPV) chemical list according to EC Regulation 793/93 [15]. This database includes all chemicals reported to be produced or imported at levels greater than 1000 tons per year in at least one Member country or in the EU region. One of the strategic goals related to this collection is constant addition of toxicological data for each chemical which will allow ultimate evaluation of the whole toxicological profile of the chemicals in the list.

Results

The model for predicting the binding effect to estrogen receptor (ER) was firstly applied on the OECD high production volume (HPV) database. It should be pointed out that the model could be applied for predicting organic chemicals only. In this respect it was found that 2874 chemicals out of the total number 4843 are inorganic or structures with unknown or variable composition. Thus, the predictions have been generated for a total of 1969 discrete organic compounds. The results show positive predictions for 167 chemicals, and in addition there is information for binding potency for each chemical (Table 1).

Table 1. Predictions for ER binding for OECD HPV chemicals segmented by ER binding categories.

Effect	Very strong	Strong	Moderate	Weak
# of chemicals	7	42	18	35

In a similar manner, the model for identification of possible chemicals as activators of the hPXR receptor was applied over the HPV database. It was found that 67 chemicals contain structural and parametric characteristics that fit these defined rules.

Discussion

The potency toward estrogen receptor could be associated with *very strong*, *strong*, *moderate* and *weak* binding effects. The benefit of this categorization is the prioritization of potential ER binders that may need further experimental testing or additional data. For example, seven chemicals are predicted to be *very strong* ER binders. From a practical point of view this is very convenient because financial resources will only be needed for seven experimental tests. In the same manner the focus can be set on *weak binders*. For example - alkylphenols which possess weak estrogenic effects are considered to be available in the environment due to their use in large scale industrial productions. Identification of chemicals with weak binding effect will result in their prevention to be used and further released in the environment.

The activation of the human pregnane X receptor (hPXR) is a contributing factor in drug–drug interactions due to its capability of binding a variety of structurally diverse molecules. The induction of metabolizing enzymes and transporters by hPXR has also been regarded as one of the major mechanisms of drug resistance in humans [16]. Activation of hPXR may accelerate the metabolism and elimination of chemotherapeutic agents, which can contribute to resistance to chemotherapy.

The identification of binders to human pregnane X receptors was performed by using a set of structural rules applied as a new profiling scheme (model) in the OECD QSAR Toolbox. A total number of 67 chemicals from the OECD HPV database were found to have structural characteristics that can activate the receptor. Compared to the ultimate number of discrete organic chemicals (1969) in the database this number corresponds to value below 4%. Considering the biological role of the PXR (to sense the presence of xenobiotics) it was expected that a larger number of chemicals would be identified by the model. As a result, it can be concluded that additional work for improvement of the model is needed.

Conclusions

In the last few years there has been a growing interest in QSAR studies which consist of important methodology used in medicinal, industrial, and environmental chemistry. Frequently, the experimental determination of biological properties of substances is very complex, time consuming, and costly. However, the use of QSAR can reduce these problems through calculations and structural analysis that predict which substances will be active or toxic, saving time and money.

In the present study, we identified a set of high production volume OECD chemicals that may have the ability to bind estrogen or human pregnane X receptors. The evaluation was performed by making use of the non-commercial platform for chemical risk assessment OECD QSAR Toolbox. For estrogen binding, an existing profiling scheme was used, and an external set of structural rules associated with PXR binding was constructed as a new model. The obtained results show that both models could be used for identification of potential binders toward both receptors. This data can be used to prioritize possible estrogen or human pregnane X binders, and significantly reduce the cost required for experimental testing.

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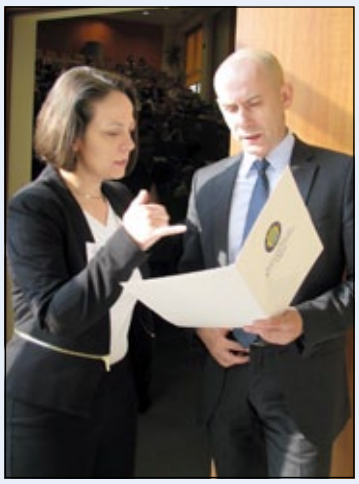








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Reviews

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DO WE NEED MORE TRAINING FOR INTERDISCIPLINARY AND INTERPROFESSIONAL COLLABORATION PRIOR TO IMPLEMENTING ANY PRIMARY CARE RESEARCH ACTION?

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A – study design, **B** – data collection, **C** – statistical analysis, **D** – interpretation of data, **E** – manuscript preparation, **F** – literature review, **G** – sourcing of funding

ABSTRACT

There has been a continuously increasing focus and discussion on interdisciplinary collaboration in primary care, across various settings and in different forums, during the past few years. Interprofessional and interdisciplinary collaboration should be a cornerstone of daily practice and context-relevant research. We considered it important for this manuscript to attempt to address some of the key issues linked to the recognised need for competence-based training, focusing on interdisciplinary and interprofessional collaboration, so as to promote and enhance context-relevant research in primary care. This article provides a general introduction and an overview of this topic, along with some key concepts and operational definitions. These key definitions and their interrelated nature are examined in detail, including those of practice-based research network, patient-centred primary care research, and interdisciplinary partnership for research. Furthermore, this paper outlines the reasons for the strong focus on composition and the development of strategies to enhance the research capacity of interdisciplinary partnerships throughout training. Workforce training, retention and academic collaboration are considered, with a particular focus on primary care, and existing interprofessional relationships and perceptions thereof. Organizational aspects influencing relationships and practice are considered along with their contribution in terms of practice, research and discourse. Finally, conclusions and recommendations, formed under the prism of rapidly changing population needs, person-centred values and the imperative need of bringing innovation to the patient in an effective and efficient manner, are presented for further discussion.

KEYWORDS: interprofessional, interdisciplinary, collaboration, primary care research

Introduction

Interprofessional primary care teams bring benefits both at patient and system levels. Most importantly, they are of high value to patients with complex care needs and represent an opportunity to improve collaboration and performance independently of the context in which they operate [1]. A key aspect for promoting and fostering such collaboration is identifying key topics through practice-based research, as well as utilizing research output to further inform research priorities and support the generation of high quality evidence for sound decision-making.

Over a decade ago, efforts in Canada took the form of an initiative for "Enhancing Interdisciplinary Collaboration in Primary Health Care" (EICP) with the aim "to create the conditions for healthcare providers to work together in the most effective and efficient way, so they can produce the best health outcomes for their patients and clients" [2]. Along the lines of this Canadian initiative to deliver research regarding best practice focused on outcomes, many other efforts have been noted across the globe. For example, practice-based research networks (PBRNs) exist in both the United Kingdom (UK) and the United States (USA), with primary care PBRNs defined as "Practice-based research networks composed primarily of primary care clinicians that focus their research and development activities on issues relevant to the primary care of patients" [3].

More recently, we have witnessed emerging efforts to link PBRNs to clinical and translational efforts, though the Clinical and Translational Science Awards (CTSA), expanding the opportunities to engage the community in the work of academic centres [4].

Examining the body of literature on research performed at general practice and primary healthcare (PHC) levels, it is clear that there are many successful stories to guide best practice, particularly in selected settings across Europe (e.g. the Netherlands, Scandinavia, and the UK), Australia, Canada, and the USA. However, despite the reported achievements, even under well-developed networks and well-supported settings such as those in the UK, additional steps need to be taken. These include the need to bridge the gap between academic and service communities, research-active practitioners and their less active peers, and to ensure stronger ties and better understanding around general practice research, in order to bring innovative approaches and therapy delivery to patients [5].

Focusing on PHC, "retaining and extending collaboration between academics and clinicians and between research-active general practitioners (GPs) and the wider practicing community" is a key step. This extending collaboration in primary care research between GPs and other primary care practitioners (PCPs) is typically absent and is more visible in settings where the concept, dynamics and values of interprofessional partnership and integrated primary care have not translated into health policy [6]. At the same time, the health needs of the population point towards a direction where more generalist skills and competences are needed. However, such training is lagging behind, with a severe lack of guidelines addressing multiple generalist and specialist competences.

The changing patterns of health and illness, with augmented chronic care needs and multimorbid patients representing the most rapidly increasing population in our ageing societies, highlight a strong need for combining social and healthcare services. Furthermore, these changes justify the need to expand professional competences and empower professionals by facilitating skill development, effective collaboration and efficient practice, despite organizational challenges they may encounter in terms of streamlining interprofessional collaboration.

These challenges and opportunities to improve the agility, adaptability and to 'upgrade' the competences of healthcare teams are recognised across the entire health workforce, including from professionals in public health. The European Public Health Association has recently released a statement on workforce emphasizing the fact that systems are lagging behind in terms of new professional competences and are falling short of adequate service provision matching the current population needs by prioritising and placing inordinate emphasis on specialisation, while generalist competences are lacking. Additionally, there is a lack of research on successful health workforce policies and innovation in leadership [7].

Current relationships between different professions in primary care and perceptions thereof need to be considered too, as teams have to overcome medical dominance and challenges emerging from the lack of integration across professions.

The need for more training for interprofessional collaboration in primary care research.

Practice-based research and networking is an important resource in assessing population health needs and improving quality of care. Accordingly, this concept and model has received significant attention in many countries. In Europe, application of the model has been limited, despite inclusion in the agenda of several WONCA networks, including that of the European Rural and Isolated Practitioners Association (EURIPA) [8]. In addition, despite the growing body of knowledge derived from RCTs designed either by GPs, nurse practitioners and clinical nurse specialists, interprofessional partnership in intervention studies in primary care is lacking. These partnerships are still of high priority and deserve more attention, with the participation of other professions to inform the research design and conduct, as well as to identify relevant topics, raise awareness on output, facilitate the uptake and translation of knowledge, and in effecting practice changes.

In addition, the current research focus is mostly disease-specific and fails to address issues of multimorbidity, goal-orientated care, patient-centredness and compassionate care in an integrated PHC context. By examining the conceptual basis of these terms, it follows that there is a need to develop training modules for interprofessional collaboration with the aim to design and implement research in PHC.

The term "integrated care" has received a lot of attention in the literature, and it is highly relevant to the term "patient-centred care". For the term "integration", we shall co-opt the definition of the World Health Organization (WHO): "[The] management and delivery of health services so that the client receive a continuum of preventive and curative services according to the needs over time and across different levels of the health system [...]" (WHO, 2008) [9]. The term 'compassionate care' also invites a partnership amongst physicians, patients and patients' families. This requires a primary care provider who is well trained in empathy and effective communication, although there are concerns regarding the extent to which compassion can be taught. Such training is clearly lacking in many settings and in most countries, although a few examples do exist [10]. It is has been reported that compassion as a feature of clinical care is decreasing [11] and that multidisciplinary research should explore the relationship between compassionate care and clinical effectiveness and quality. Multimorbidity pertains to the management of individuals with two or more health conditions simultaneously [12]. Multimorbidity is often a problem of aging and increasing frailty, although frailty is more of a clinical syndrome than a disease. Elderly people present an increased risk for poor health outcomes including falls, incident disability, hospitalization, and mortality [13–14]. Effective management of multimorbidity requires integrated

care and this becomes apparent when mental illness intersects with multimorbidity.

Enhancing interdisciplinary and interprofessional partnerships in research-what do we need?

In 2001, the concept of 'research training' entered medical specialist training as a mandatory component of the Danish national regulatory body for doctors. A decade later, reporting indicated that equipping PHC providers, including GPs with skills pertaining to participatory design and to promoting overall collaboration with GP academics and clinicians was possible. However, an inherent generic barrier within academic settings was also highlighted, i.e., the lack of regulation [15].

It is clear that interdisciplinary teams are dynamic and not static and they include many professionals with a composition that varies in terms of the setting and the context of the primary care system, as well as the specific purpose that the partnership serves. The interdisciplinary collaboration in Primary Health Care in Canada provides a snapshot of the range of professions comprising such teams, with an emphasis on community-based teams, teams serving hospices or remote communities and nurse/physicians teams [16]. Regarding the latter group, the collaboration of both practitioners with psychiatrists, behavioural intervention specialists, educators, speech therapists, psychologists, case managers, and paid caregivers has been reported in certain privileged settings, including in Australia. However, such extensive collaboration is not the case in many PHC settings, where the primary care team is restricted to a small number of staff, including one GP and one nurse.

Another issue that deserves some additional attention is the content, structure and methods of the training programme. Efforts to increase the interdisciplinary focus in PHC research by developing and implementing training programs have been undertaken in some countries and examining one such well-developed programme highlights core aspects that should be considered in PHC, the Transdisciplinary Understanding and Training on Research- Primary Health Care (TUTOR-PHC) [17]. Two key questions guided the design and implementation of this training program: "what challenges exist in training excellent and productive PHC researchers?" and "what training is being done in the area of interdisciplinary PHC"? Both are critical since the core disciplines in PHC vary significantly among different countries and settings, while the second question has been addressed, in part, through several MSc programmes available across countries. The second option of the second question merits much interest since it highlights the importance of meeting the needs of PCPs who participate in translating clinical findings and questions in research hypotheses and programmes. It has led certain institutions to develop disease-specific programs where interprofessional partnership has been approached. Certainly, it is not the case for settings where both primary care research and interprofessional collaboration is still underdeveloped [18].

Thus, it is challenging to discuss both the content and the structure of interprofessional training in PHC and its structure and methods. Major public health problems on a local population level offer another chance to explore the possibility to integrate public health into primary care. This principle is supported by several international organisations, including the WHO. Fields where primary care research still seek clinical effectiveness and recognition, including home and nursing care and in clinical entities such as frailty and ageing healthcare, represent excellent areas where the training for interprofessional collaboration in PHC could be attempted.

Conclusion

Considering the ageing population of Europe and the need for maximising synergies of public and primary care, workforce training needs need to encompass interprofessional collaboration, research conduct and expertise on population-based medicine. Such efforts will benefit from strong community links, with participatory efforts extending well beyond the clinician-patient interaction, to the PHC team-citizen interaction. Academic centres have a unique role to play in both research and practice by establishing living labs encompassing practice-based networks. Within their remit should be the provision of appropriate training to address the current misalignment of perceptions of PHC teams in a structured and context-relevant manner. Furthermore, training should facilitate interprofessional collaboration and context-relevant research and knowledge translation. Key modalities to guide and drive such training and overall efforts should include the management of chronic disease in the context of a collaborative team, public health tools such as screening, promotion and prevention programmes, and, of course, primary care research methodology. Efforts to generate appropriate syllabi to modernise the curriculum of formal undergraduate and postgraduate education to the direction of interprofessional education and with emphasis on communication aspects, collaboration, generalist skills, and chronic care management would go a long way towards bridging current gaps. Progress towards managing current societal needs and the needs and expectations of patients with chronic illness relies on the development of interprofessional guidelines. These should be developed not only for the primary care team, but for PHC teams collaborating with specialists in the care of multimorbid and chronic patients at community and system levels, including monitoring of cancer survivors and caring for those in remission.

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THE VALUE OF INTERDISCIPLINARY RESEARCH: LESSONS FROM THE 2017 NOBEL PRIZE IN CHRONOBIOLOGY

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A – study design, **B** – data collection, **C** – statistical analysis, **D** – interpretation of data, **E** – manuscript preparation, **F** – literature review, **G** – sourcing of funding

ABSTRACT

Since 1901, the Nobel Prize has been awarded to scientists who have made the most important discoveries for the benefit of humanity. The 2017 Nobel Prize in Physiology or Medicine was awarded jointly to Jeffrey C. Hall, Michael Rosbash and Michael W. Young "for their discoveries of molecular mechanisms controlling the circadian rhythm." It may be surprising to learn that those three scientists dedicated their entire careers to research on the fruit fly, *Drosophila melanogaster*. However, as their studies progressed, it became increasingly clear that the mechanism of the biological clock that they discovered in *Drosophila* is very similar to a timekeeping mechanism present in mammals, including humans. Through interdisciplinary work between scientists performing basic research on model organisms and doctors working in medical schools, we have learned over time that daily rhythms support human health while disruption of these rhythms is associated with a range of pathological disorders such as cardiovascular problems, metabolic, neurological, and many other diseases. This short review will highlight critical milestones on the way to understanding biological clocks, focusing on the roles played by the three Nobel Prize winners.

KEYWORDS: circadian rhythms, biological clock, Drosophila, human health

Most animals lead rhythmic lives; some are active at night and sleep during the day while others are diurnal being active during daytime. These rhythms are not merely a response to a daylight or darkness at nighttime. When animals are placed in constant conditions such as constant darkness, they do not lose a sense of time but rather maintain rhythmicity that has a period of about or "circa" 24 hours; therefore, these cycles are called circadian rhythms. Even humans isolated from a solar day and left to schedule their own activities maintain a clear circadian rhythm of sleep and wakefulness. These types of experiments demonstrate that organisms have evolved their own internal timekeeping mechanism, which is synchronized (entrained) daily to a 24h solar cycle. The internal sense of time allows us to anticipate cyclically occurring daily events. For example, before we wake up, our internal clock orchestrates an increase in blood pressure and levels of cortisol to prepare us for activities of the day. The understanding of how our clocks operate at the molecular level emerged from basic research involving organisms approximately 10 million times lighter than human.

The discovery of the first clock gene

The question of how animals and humans can measure time has intrigued scientists for many decades. The mechanism of circadian clocks remained a total mystery until researchers working with fruit flies, *Drosophila melanogaster*, used the knowledge about fly rhythmic behavior to demonstrate that the fly clock has genetic basis. Fruit flies have been used as a genetic model for over a hundred years, as they possess a short life cycle of 10 days from egg to adult, a high reproduction rate, and there are well-established methods to induce and map mutations in their genome. It was known that adult fruit flies emerge from their pupal cases in a rhythmic fashion (in the morning) and a free-running rhythm of adult emergence persists in constant darkness. The experimental approach was to mutate hundreds of flies and test whether any of them would emerge at the "wrong" time, suggesting that they could carry a circadian timing mutation. Indeed, the authors of this study, Ron Konopka and Seymour Benzer, discovered that a single genomic locus named *period* (*per*) carried three different mutations [1]. One mutant completely lost the emergence rhythm (per^0), another mutation shortened the free-running rhythm from circa 24h to 19h (per^{short}), and the third mutation produced long-period rhythms of 29h (per^{long}) of adult emergence. Excitingly, the same mutations caused corresponding changes in the locomotor activity rhythms of individual flies, indicating that the *period*

gene is part of the clock controlling different behavioral rhythms.

Work of Nobel Laureates on the clock mechanism

The discovery that the gene *period* was necessary for circadian rhythms in flies was the first milestone on the way to understanding the mechanism of biological clocks. However, the sequence and function of *period* remained unknown until the mid-80s, when novel genetic and molecular tools were developed in *Drosophila* allowing DNA sequencing and introducing pieces of cloned DNA into the fly genome. An interdisciplinary team led by behavioral geneticist Jeffrey Hall and molecular biologist Michael Rosbash at Brandeis University used these tools to characterize the *period* gene. Meanwhile, another scientist Michael Young at Rockefeller University also attempted to sequence *period* DNA and determine whether it was indeed a part of the circadian clock. The Brandeis and Rockefeller teams independently demonstrated in 1984 that the introduction of *period* genomic fragments into an arrhythmic per^{01} mutant caused rescue of both adult emergence rhythm and locomotor activity rhythm [2,3]. Further studies in the labs of J. Hall and M. Rosbash showed that PER protein [4] and *per* mRNA [5] undergo daily oscillations and suggested that clock may consist of a negative feedback loop with the PER protein acting as a repressor [5]. Meanwhile, another mutant that abolished circadian rhythms in flies was uncovered in the laboratory of M. Young [6]. This second clock gene was named *timeless* (*tim*) and the TIM protein turned out to be a partner of PER, necessary for its stability and nuclear entry [7,8]

Although it was evident that PER and TIM proteins somehow affected transcription of their own genes, the mechanism was not clear owing to the fact that these proteins did not possess DNA-binding domains; therefore, they could not directly affect transcription of their own or other genes. Fortunately, a search for more arrhythmic mutants in the labs of J. Hall and M. Rosbash revealed two genes encoding transcription factors CLOCK [9] and CYCLE [10] that had known DNA-binding domains and could bind to *per* and *tim* promoter region and activate their transcription. Interestingly, the *Clock* gene was first identified as part of the mammalian timing mechanism [11], and interdisciplinary communication between fly and mouse researchers greatly facilitated the progress in the understanding of the circadian clock.

Human circadian clocks are remarkably similar to fly clocks

By the turn of the century, it was clear that the fly clock operates as a negative feedback loop involving transcription and translation of several clock genes. A simplified version of the core feedback loop in *Drosophila* was reviewed recently [12] and is shown in Figure 1. Two transcription factors encoded by the genes *Clock* (*Clk*) and *cycle* (*cyc*) act as the positive limb of the clock, whereby CLK-CYC form heterodimers, which bind to the E-box sequences in the promoters of *per* and *tim* genes, stimulating their transcription in the early night. PER and TIM proteins act as the negative limb of the clock when they accumulate in the cell nuclei late at night and repress CLK-CYC activity. This results in the suppression of *per* and *tim* transcription until the repressive PER and TIM are degraded. Degradation of TIM is initiated by light via the photoreceptive CRY protein encoded by the *cryptochrome* (*cry*) gene characterized in *Drosophila* by J. Hall and M. Rosbash [13,14]. Upon activation by light, CRY binds to TIM protein leading to its degradation. Because TIM stabilizes PER, the latter is also degraded within few hours of lights-on. The progress in the understanding of the fly clock was followed closely by discovery that the negative feed-

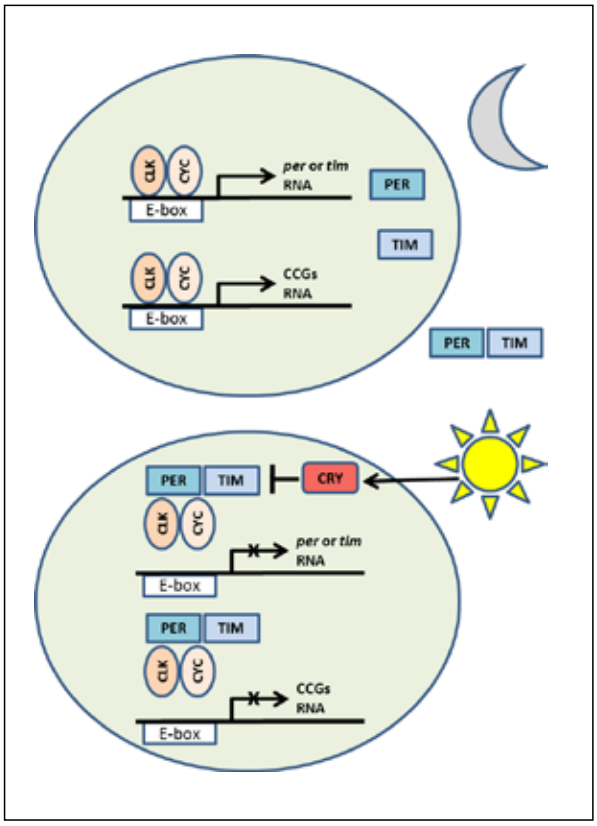

Figure 1. Schematic depiction of the negative feedback loop that forms the core mechanism of the *Drosophila* clock. At night (upper panel) the CLK/CYC heterodimers bind to E-box sequences in *per* and *tim* promoters and activate transcription of these genes. Resulting PER and TIM proteins form heterodimers, enter the nucleus and bind to CLK/CYC repressing further transcription of *per* and *tim*. Morning light activates the CRY protein (lower panel) which binds to TIM causing its degradation. PER, which is stabilized by TIM, also degrades, ending the repressive phase of the clock and allowing positive arm of the clock to restart. Many clock-controlled genes (CCGs) also contain E-boxes in their promoters and their transcription is directly stimulated by CLK/CYC. Some of these CCGs encode transcription factors, which indirectly generate rhythmic transcription of additional CCGs. Figure based on reference [12].

back loop is at the core of the circadian clock in mammals, including humans. Mammalian clocks operate by the same mechanisms and contain mostly homologous genes as *Drosophila* clocks. A major difference between fly and mammalian clocks is the use of CRY, rather than TIM, as the PER partner. Mammalian CRY lost light sensitivity and gained a function as the circadian repressor.

Based on early observations of behavioral rhythms in sleep/activity, feeding, and cognitive functions, it was assumed that the clock would reside in specialized neurons. Indeed, the circadian clocks regulating behavior have been identified in the specific brain neurons of mammals and insects using perturbation of locomotor activity rhythms as a readout of clock function. However, it is now well established that animals possess multi-oscillatory circadian systems with master clocks residing in the central nervous system and peripheral clocks present in cells forming most other tissues. The existence of peripheral clocks that can function independently of the brain was first demonstrated in moths [15], then in *Drosophila* [16] and finally in mammals [17]. Clocks that exist in cells making up most body organs in flies and mammals provide the temporal framework to organize activity of different tissues, allowing synchronization of compatible and separation of incompatible processes. The molecular rhythms generated by the tissue-specific clocks contribute to rhythmic physiology such as daily fluctuations in the levels of hormones, enzymes, and various metabolites. In fact, nearly all aspects of metabolism vary with time of day, at both cellular and systemic levels [18]. These rhythms are tightly connected to daily cycles of food intake, digestion, motor, and cognitive activities that are followed by sleep associated with fasting and cellular repair.

Circadian clocks are important for human health

Studies in model organisms show that disruption of circadian rhythms may have pathological consequences. Laboratory mammals with genetically engineered defects in their circadian clocks show many pathologies including obesity, diabetes, steatosis, cardiomyopathy, and atherosclerosis [18]. There is also accumulating evidence that age-related disruptions of normal circadian rhythms and sleep cycles can affect neuronal health and contribute to pathogenesis of neurodegenerative diseases, such as Alzheimer's disease [19]. A Nobel Prize for the discovery of the circadian clock mechanism may increase the awareness of "circadian hygiene" that humans should maintain to stay healthy. Eating, working and sleeping at the right time of the solar day supports human health and wellbeing, while disrupting these natural rhythms may be associated with a host of pathological problems. Increasingly, modern humans tend to impair their natural circadian rhythms by shift work and travel across time zones. In addition, irregular eating habits and prolonged exposure to artificial light emitted by electronic devices disturbs our clocks and reduces sleep, which has detrimental effects on attention and learning.

Concluding remarks.

The discovery of the circadian clock was driven by the curiosity of scientists coming from different fields of study and collaborating by putting together their respective expertise. Such interdisciplinary approach is always evident at the meetings of the Society for Research on Biological Rhythms, which brings together researchers working on clocks in bacteria, plants, and animals as well as clinicians. They can learn from each other because most molecular pathways are conserved in evolution and human cells function and divide by the same mechanisms as in flies. The Nobel Prize for three fly scientists highlights the unity of fundamental life processes and underscores the value of basic research on simple model organisms for the understanding of our own physiology and for making progress in preventing and treating various human diseases.

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SCIENTIFIC WRITING FOR THE BIOMEDICAL SCIENCES

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A – study design, **B** – data collection, **C** – statistical analysis, **D** – interpretation of data, **E** – manuscript preparation, **F** – literature review, **G** – sourcing of funding

ABSTRACT

Scientific writing is an essential part of a research scientist's career and is usually the end process of many years' hard bench work generating the data for publication. Clear communication of your research findings, the aims and potential importance of your work are the foundation of all good scientific manuscripts. Writing a scientific manuscript in English, especially if English is not your first language, can make an already challenging task even more difficult.

The purpose of this article is to assist authors in the preparation of manuscripts intended for submission to peer-reviewed journals. The article mainly focusses on the biomedical sciences, but researchers of other scientific disciplines can also benefit from the content. We provide useful advice on all the main subsections of a standard research manuscript, from selecting an appropriate title, through to preparing a properly organized discussion. Advice on how each section should be arranged as well as points to be avoided can be found in the guide. As a general guide the most important point of a manuscript is that the research findings contained are presented clearly and accurately without excessive repetition or embellishment. Finally, this article closes with a section which contains language mistakes which are frequently made by authors whose first language is not English.

KEYWORDS: academic writing, biomedical sciences, article sections, tips

Introduction

Writing a manuscript is an extremely challenging task, particularly if English is not your first language. It can take many weeks and months of drafting and redrafting to get it right. As researchers, we have acquired specific skills related to writing a good scientific manuscript, mainly through our personal experiences as well as those of more experienced co-authors and reviewers. We are also key members of eCORRECTOR, a company providing an expert scientific proofreading service, where we see, on a daily basis, the array of common language mistakes made by scientific authors. This article is designed for authors intending to submit their work for publication in international peer-reviewed journals. The article focuses on biomedical sciences; however, authors from most other scientific fields may also benefit from the advice it contains.

Subsection-specific advice for a standard manuscript

The first part of the paper is, in fact, not the abstract, but the title itself. Although finding a suitable title should be straightforward, it can often be one of the most difficult parts of a paper to perfect. The title should be concise, yet accurately describe the main findings of the study. In other words, it needs to be short, convey the main result, and be just broad enough, particularly if it will be submitted to higher impact journals. Essentially, a title needs to be a clear statement about your work. Avoid writing general statements (which are, admittedly, considerably easier to write). For example "Drug X increases dopamine release in the rodent prefrontal cortex" is a better title than "The effect of drug X on dopamine release in the rodent prefrontal cortex". This rule also applies to subtitles within the manuscript – if written properly, they will make your manuscript easier to read, and the results will be considerably clearer to the reader.

One of the shortest parts of the paper, namely the abstract, is usually subjected to the largest number of changes. They can be frustratingly minor, yet necessary when you want to include a strong message within the journal's strict word count. The most efficient approach is to write the abstract once you have a good working draft of your paper; during the writing process, the key

points of the paper will have become more distilled in the mind of the author(s).

A good abstract should summarize all the major aspects of your paper in a concise way. Since abstracts are short, stick to your main results rather than trying to cram in as many details as possible. Make sure that the abstract properly reflects your key findings, in addition to the implications of your results. A reader should be able to understand the message of the paper from reading the abstract alone. It is therefore crucially important to get this part of the manuscript right, as it is often the only part a reviewer will have access to before deciding whether to review the whole paper. It is also the first part any reader will look at to obtain information about the quality and content of the paper. Therefore, make absolutely sure that you have drafted and proofread it several times until you are completely satisfied with the text. The closing sentence of a good abstract will identify the implications of your research, for example advances in clinical diagnoses, novel drug effects, or new pathological mechanisms.

Most journals have their own submission guidelines for writing an abstract, and it is crucial to adhere to these guidelines. The following guidelines are taken from the journal "Biological Psychiatry", which, in our opinion, provides a helpful structure to follow [divided into Background, Methods, Results, Conclusions].

An introduction does not need to be long, and it should never become an extended review of the literature. There is no point in trying to impress reviewers with your subject matter knowledge; the key is to be concise and to cover the key points pertinent to the aims of your research. Basically, the introduction should ideally provide a clear and coherent description of the background literature with appropriate referencing of the main claims. It should establish the context of the current work in relation to previous research. The scope and objectives of the study should also be explicitly stated. In addition, details of the methodology and rationale for using it might also be included. It is extremely important to justify the significance of your study and the reasons for carrying out the research. The introduction is where you must make sure the aims and hypothesis are explained clearly. Good examples of grounds for carrying out your work may lie in the extension of previous work, a gap in understanding a particular phenomenon, or resolving a contradiction.

Authors may find following this general structure helpful when preparing their introduction. The first paragraph should be a general presentation of the problem and a discussion of why it is interesting from the academic viewpoint (is it related to energy storage, drinking water, pharmaceuticals, specific diseases, consumer technology, sustainability, food production, etc.?). The following two to three paragraphs should describe in more detail the previous research projects carried out by different scholars with an interest in this problem, as well as related achievements to date of both other teams and your own (try to reference your work in an appropriately balanced manner). The final paragraph should outline the aims and objectives of the article, along with the overall hypothesis put to the test.

The **materials and methods** section should be relatively straightforward and less time-consuming. Short, sharp sentences are often useful here, as the style of this section tends to be rather dry. The most important aspect is that it contains all the necessary information required for another scientist to replicate your experiments and cross-check your results.

Generally, there are established standard operating procedures that may be revised to reflect the experimental protocol used in the study. It is acceptable to reference previously published methods as long as this is done accurately and the reference contains complete information. If you have a complicated experimental paradigm or numerous experimental groups, it may be wise to describe your methods/structure of experiments graphically, e.g. in the form of a table or a flow chart.

If an ethical statement is required, for example due to the use of laboratory animals or human volunteers, this should be stated clearly. Many journals have their own preferred way to phrase this part, usually mentioned in the guide for authors. It is important to include a separate statistics file describing the statistical analyses used.

The results (and discussion) sections are the heart of any research article. There is often a great deal of flexibility about the arrangement of the results, the order in which they are described, the contents of a figure, and what has to be described within the text of the results. It is down to the author(s) to decide how to structure this particular section to best reflect their goals. The paragraph below mentions some pieces of advice we have found particularly useful when preparing our own papers and editing those of others.

First, it is crucial to make sure the results are organized in a logical order – not necessarily the chronological order in which the study was carried out. It is often helpful to break down your results section into smaller 'bite-size' subsections. This helps to create a rational flow for your results, as they become more in-depth as you progress further. It is widely considered more appropriate for subsections (and titles of figure captions) to be expressed as statements, i.e. "d-tubocurarine induces spike and wave seizures" rather than a vague caption such as "The effect of d-tubocurarine" (see title). When preparing the results section, it is paramount to remember that this section should be written objectively, with all opinions and evaluations left for the discussion. Interpreting your findings should be avoided; however, it is perfectly acceptable to include statements such as "In line with previous findings, we observed..... (citations)."

The results section goes hand-in-hand with the figures used – it is considerably easier to write the results if they are supported by figures. Use this as the foundation for writing your results. It is important to keep this section concise and avoid repetition of what is shown

in the figures and tables. In particular, the numerical values shown in figures/tables should not be repeated in the body of the results section. Beginning the preparation of results by arranging the figures ensures that there is sufficient data to clarify a logical order for the points raised, as well as to warrant publication in the first place. Preparing figures is often the most time-consuming part of the writing process, since it ultimately involves statistical analyses to test research significance. Make sure you use appropriate statistics and tests for normality. Statistical differences are the core of most papers, and reviewers are always asked to comment on whether the correct approach has been used.

When creating figures, it is crucial not to place quantity over quality. There is little benefit for the reader or the author to have a manuscript with 10 single-graph figures when they could be combined into just a few far more comprehensive figures. Ideally, each figure should be a stand-alone result that conveys a particular message. It is important to note that figures, as well as tables, should be self-explanatory, which means that the reader should be able to fully understand the information presented without having to go back to the text. In particular, all abbreviations need to be defined either in the caption or in a footnote. When readers have read through all the figures/tables, they should be able to understand the complete message of your work. Moreover, authors and editors have to ensure that the figures/tables are internally consistent in terms of layout and numbering (i.e., A, B, C – a, b, c – i, ii, iii). It is advisable to check the guidelines of your target journal in this regard.

A useful piece of advice given to one of the authors during their PhD research was that a reader should be able to read your discussion without having read the rest of the paper and be able to understand the main purpose, findings, and importance of your work. Therefore, the first paragraph of the discussion should be a concise summary of key research results – the most important findings, presented in a logical flow. Try to write in a concise manner and do not repeat yourself, unless it is a summary paragraph. Providing the same argument more than once, if not for the purposes of development, is a sign that the discussion has not been constructed properly. The authors should also ensure that the findings are discussed appropriately in terms of other published works. There are several questions that should be answered in this section, e.g., whether the results are consistent with other works or whether they differ, and if so, in what way? It is possible that methodological/analytical differences may account for this. Furthermore, it is customary to end this section with a few closing remarks on the broader significance and future directions of the research presented, preferably regarding the possibility of advancing our existing understanding of a process or new applications.

As you discuss your results, make sure to keep the original purpose of the paper in mind and try to bring the discussion back to this point wherever possible. This will make the paper seem more focused and reinforce the relevance of the work to the reader. This section is certainly not the place for digressions and introducing new ideas. It is easy to fall into the trap of following a potentially interesting, yet new, idea and then venturing into an area outside the original scope of the study. It may be a wonderfully written paragraph, but in the context of the paper, it might not be as relevant as initially thought. Although it may seem painful, after all that hard work, it is better to remove such unnecessary paragraphs and save them for a different publication, grant application, or review.

It is crucial to realize that a research paper – despite the significant effort put into preparing it – might not be perfect. Whilst you do not want to draw attention (either your own or that of the reviewers) to the shortcomings of your own study, it is important to be slightly self-critical. After perfecting the content of the publication, authors must reassess it from the viewpoint of possible limitations and areas that might be interpreted more cautiously. The last stage of writing a paper is re-checking it structure-wise, e.g., checking whether paragraphs and subsections are constructed properly. Long paragraphs (20 lines or more) or many short paragraphs (five lines or fewer) make reading difficult. This is also the last opportunity to arrange the text in a logical manner so that it essentially tells a story consisting of the main points of your work.

A good research paper is concise, straightforward, and avoids the use of any unnecessary "filler words". Or, in the words of Antoine de Saint-Exupery: "Perfection is achieved not when there is nothing more to add, but when there is nothing left to take away".

Common language mistakes in scientific writing

It is beyond the scope of this paper to provide a comprehensive list of language-related mistakes in scientific writing. Our experience at eCORRECTOR demonstrates that even native English speakers frequently introduce errors into their papers if their language skills have not been consolidated along the way. Using a specialist proofreading service is the most efficient way of making sure that the publication is ready for print. It is advisable to let someone else read the paper: our minds tend to overlook the logic-related gaps in structures we have created ourselves. Despite our shortcomings, each author can perfect his or her work language-wise by following a few simple steps.

1. Keep your writing simple and straightforward. Long sentences with several subordinate clauses often lead to confusion. They may be perfectly clear in your native language, but ambiguous when put into English. It is best to split up such sentences into two or three shorter ones, making sure that the meaning of words such as 'substance' or 'process' is obvious. If there is more

than one complex, it is possible to refer to these as 'complex 1', complex 2', etc. On the other hand, using only short, single-phrase sentences may seem somewhat immature. This aspect of the text must be balanced – conjunctions are indispensable when it comes to structuring the flow of thoughts within your publication.

2. The bulk of a paper, including the experimental methods and results, is generally written in the past tense. Shifting between past and present tenses in the middle of a description should be avoided.
3. Misplaced apostrophes, such as in 'Alzheimers' disease' (should be 'Alzheimer's disease') or 'Both precipitate's were…' (should be 'Both precipitates were…'), are a common source of misunderstandings. Similarly, in statistics, it should be a 'Student's t-test' with a capital letter and an apostrophe, since 'Student' was a pseudonym used in research.
4. When denoting decimals, for Polish readers, a comma (,) is used rather than a decimal point (.). This mistake can be dangerous if the target reader assumes the English manner of writing numbers. Stating 'Carefully add 1,250 g of the unstable catalyst' when this should be 1.250 g, might lead to one thousand two hundred and fifty grams being added, when it should be just one and a quarter. All English-speaking countries use full stops (periods) to separate decimals.
5. Another frequent problem is the misuse of 'made' where 'carried out' or 'run' is needed. For example, 'The experiment was made under both acidic and basic conditions' should in fact be 'The experiment was run (performed) under both acidic and basic conditions.' In English, we *make* a cake or *make* a noise, but *carry out* or *run* experiments. Many researchers, including senior investigators, also make this mistake when talking about their PhD and say 'when I made my PhD research', whereas it should be 'when I carried out my PhD research'.
6. Linking devices must be checked for their function, as it is easy to misguide the reader by using "furthermore" or "consequently" in the wrong context.
7. Mixing UK and US English spelling is probably the most common inconsistency in academic papers. This can be improved easily by running a spellcheck in a text editor. This may also identify many other typos or errors in the text. It is also important to keep in mind that in American English, a comma is placed before "and/or" in lists, the so-called "serial comma", which is omitted in British English.
8. Although it is acceptable in most forms of writing, contractions such as "we're" or "it's" should be eliminated from academic publications. It is tempting to use them and shorten the word count but definitely should be avoided.
9. Each language has its own sentence structure. Some are appositional, meaning that the word order is less fixed and the meaning may be decoded largely based on inflectional endings, while others – including English – require a specific way of forming sentences. It is crucial to check whether each sentence has a clear subject, verb, and object in the correct order.
10. The so-called false friends, or *faux amis*, are a constant source of trouble when searching for the correct equivalent in a foreign language. For instance, the word "eventually" causes many misunderstandings among Polish scholars, due to the association with the word "ewentualnie" [alternatively]. The correct meaning of this English word relates to the outcome, not to the alternative.
11. Authors (both native English speakers and scientists from non-English speaking countries) are frequently confused about when to write out numerals. As a general rule, numbers up to nine are spelled out, while numerals are used from 10 onwards, unless associated with a unit of measurement/time, in which case numerals are used (except at the start of a sentence). Numerals are also acceptable in a list, especially a list with numbers both lower and higher than 10.

As mentioned before, this list could be expanded to include a wider array of aspects to consider while revising a publication. Since English is considered to be the *lingua franca* of the scientific community worldwide, most papers are prepared in this language. Reviewers are trained professionals with a mission to fish out articles with the greatest scientific potential. Going through the points mentioned above increases the probability of receiving positive review results, since the findings will be presented in a confident and considered manner.

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Reviews

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AIRWAY MANAGEMENT – A REVIEW OF CURRENT METHODS, GUIDELINES AND EQUIPMENT

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A – study design, **B –** data collection, **C –** statistical analysis, **D –** interpretation of data, **E –** manuscript preparation, **F –** literature review, **G –** sourcing of funding

ABSTRACT

Maintaining airway patency is an essential issue in many fields of medicine. The modern approach to CPR, which focuses on maintaining airway, breathing, and circulation was finally established by Peter Safar in his book *ABC of Resuscitation* (1950). At present, along with the development of evidence-based medicine, techniques which are proven to be clinically effective are regularly published in a convenient form – as bundles and guidelines. Regarding airway management, ERC and DAS guidelines are the most reliable and useful sources of knowledge and practical clinical advice. Among the medical staff, there is emphasis put on the mastery of ABC techniques. Airway management is the first step in the resuscitation algorithm. It consists of a variety of procedures ranging from simple and non-invasive to more complex, requiring professional training and experience. Currently, the most clinically effective and life-saving actions are incorporated into whole procedures and bundles, such as ERC or DAS guidelines, which are evenly checked, evaluated and, eventually, modified. This method of regular revision allows us to keep all medical professionals at the same level of competence.

The aim of the study was to describe basic and advanced techniques, methods, and devices which are currently used to provide it. Currently applicable guidelines regarding CPR and airway management were reviewed and summarized.

KEYWORDS: airway, LMA, LT tube, Guedel, intubation

List of abbreviations: BLS – basic life support; CPR – cardiopulmonary resuscitation; DAS – Difficult Airway Society; ERC – European Resuscitation Council; GEB – gum-elastic bougie; LMA – laryngeal mask; SAD – supraglottic airway device.

Maintaining airway patency is an essential issue in many fields of medicine. It plays a crucial function especially in emergency medicine, anesthesia, intensive care, and first aid. Airway management devices and techniques are also inseparably related to cardiopulmonary resuscitation (representing the "A" in ABC) or Difficult Airway Society guidelines. The importance of assuring correct gas exchange and oxygenation is indisputable, having been clearly stated centuries ago. Back in the 16th century it was discovered that air must reach the lungs to give an unconscious victim any chance for survival. Thus, first attempts for preserving gas exchange utilized bellows (like those used by blacksmiths) to transfer an air into a patient's airway. That method was ultimately withdrawn by the 18th century due to the significant disadvantages and difficulties surrounding it. Further developments were made in 18th century, when the Dutch Humane Society was founded. The aim of this group was to rescue people drowning in the waterways. Each saved life brought

a monetary reward for rescuers, which stimulated a wealth of ingenuity among the lifesavers. Some techniques used then may seem a little bit strange, such as suspending the victim upside down or rolling him on a barrel. At the same time, endotracheal cannulae were used for the first time. The modern approach to CPR, which focuses on maintaining airway, breathing, and circulation was finally established by Peter Safar in his book *ABC of Resuscitation* (1950). Along with the progress of technology and medicine, more sophisticated and effective ways to provide adequate oxygen delivery and carbon dioxide elimination were developed and subsequently established [1–3].

The airway is generally divided anatomically into upper (consisting of the oral/nasal cavity, pharynx and larynx) and lower segments, which include the tracheobronchial tree and lungs. Obstructions may occur at any level of the respiratory tract, resulting in impairment of gas conduction and its exchange. Possible causes of an airway obstruction include:

1. Infection – laryngotracheitis, bacterial tracheitis, peritonsillar abscess, retropharyngeal abscess, epiglottitis
2. Aspiration of a foreign body.
3. Unconsciousness – regardless of its origin. Glasgow Coma Score of 8 or less predicts loss of airway patency and is an indication for endotracheal intubation. The obstruction is caused by the base of the tongue sagging against the posterior pharyngeal wall.
4. Facial or laryngo-tracheal trauma.
5. Anaphylaxis, excessive laryngeal stimulation.
6. Paralysis of the vocal cords (e.g. iatrogenic).
7. Pulmonary edema, bronchospasm, bronchial secretions, aspiration on gastric contents – affecting lower airway.
8. Tumors – due to either occluding the lumen or exerting external pressure.

Airway management may be divided into two general categories: basic (or non-instrumental) and advanced (includes also instrumental techniques).

Basic techniques are non-invasive, simple, and relatively easy to perform. There is no need to use any equipment to carry them out. Basic procedures consist of:

1. head tilt–chin lift – one of the quintessential man oeuvres from BLS guidelines, used to obtain airway patency and assess a patient's breathing. It is also widely used in anesthesiology, intensive care, and emergency medicine, usually to increase the efficiency of bag-valve-mask ventilation. May be followed by a finger sweep or jaw thrust to further improve its effectiveness. One hand is placed on a patient's forehead, the other hand is put just below the chin. Then, the forehead is pushed backwards while the chin is lifted upwards.
2. Esmarch maneuver (jaw thrust) – typically used to restore airway patency in patients with cervical spinal cord injury or as a supplement to head tilt-chin lift. The mouth is gently opened and chin displaced downwards using your thumbs, while the mandible's angle is moved forward using the other fingers. In a case of cervical spine injury, the MILS (manual in-line stabilization) is performed by an assistant. However, in life-threatening situations, obtaining airway patency is more important than potential neurological detriment (Fig. 1).

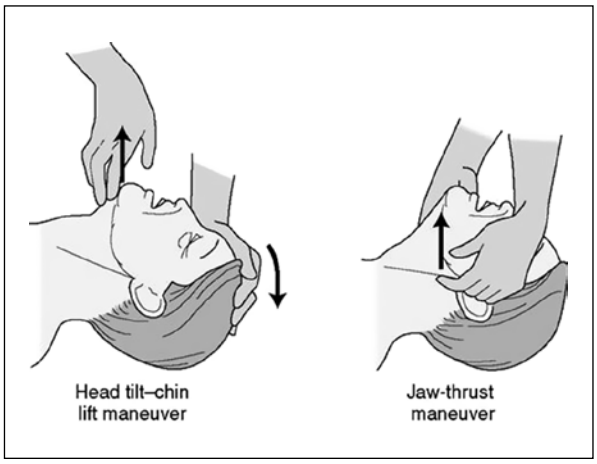

Fig. 1. Basic (non-instrumental) techniques airway management

3. Sniffing position, ear-to-sternal notch, ramped head – these are the types of head positioning performed mostly in the operating theatres to facilitate view during laryngoscopy. They also improve airway patency and respiratory mechanics, making bag-valve mask ventilation easier [4].
4. Finger sweep – removing a visible foreign body from the airway. A blind finger sweep is not recommended.
5. Back blows and abdominal thrusts – carried out in cases of foreign body airway obstruction (FBAO), and included in BLS guidelines. Should be performed in victims with severe FBAO. First, the patient leans forward (while supported with the rescuer's hand). Then the rescuer stands to the side and gives up to five firm blows between the shoulder blades. If ineffective, abdominal thrusts are performed – the rescuer stands behind the patient with their hands clenched together between victim's navel and ribcage. The rescuer delivers a sharp inward and upward pull (up to five times). If still ineffective, back blows should be performed again. It is very important to recognize choking and its severity, because techniques described may be harmful in mild choking. If the victim's condition is worsening, CPR should be started.
6. Recovery position – performed in spontaneously breathing persons. The tongue and jaw fall forward under gravity, thus improving the airway patency and offering a degree of protection against aspiration of stomach contents (Fig. 2).

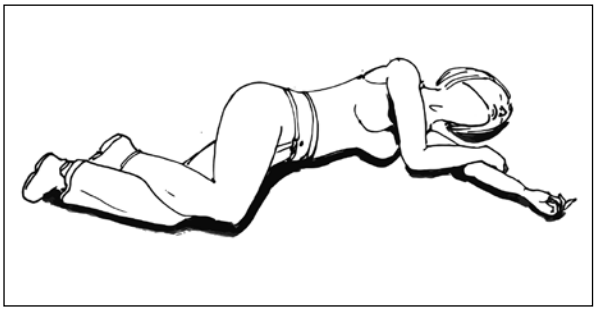

Fig. 2. Recovery position (source: wikipedia.com, author: Rama)

Advanced airway management includes the use of more sophisticated equipment. The most important and popular instruments are:

1. Naso–pharyngeal tubes (NP) – widely used in emergency medicine (Fig. 3). These devices maintain patency between the tongue and posterior pharyngeal wall. They are softer and much less irritating than the oropharyngeal tube, and are thus suitable for conscious and unconscious patients. They have proven utility in anesthesia, e.g. during gastroscopy. Very helpful in cases of trismus or clenched jaws. Size is adjusted according to the diameter of the patient's fifth finger (usually 6mm for females and 7mm for males), although height provides more accurate matching. The NP tube should be inserted (with lubrication) into the nostril, pushed carefully downwards, parallel to hard palate to minimize trauma to nasopharynx. Presence of a base skull fracture puts the patient at risk of intracranial tube insertion. NP tube placement is contraindicated in patients on anticoagulation agents or in epistaxis [5,6].

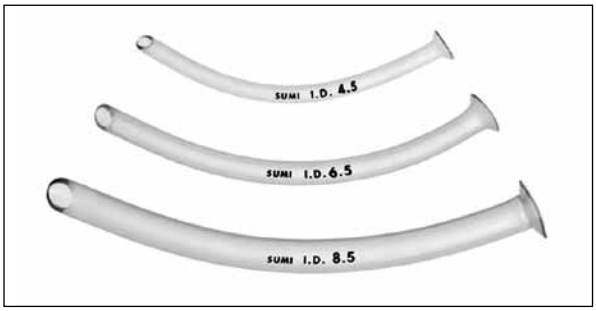

Fig. 3. Nasopharyngeal airway (source: under courtesy of Sumi Ltd. www.sumi.com.pl)

2. Oro–pharyngeal tubes – these are Guedel (hollow) (Fig. 4) or Berman devices. Used in unconscious, unresponsive patients as they are more irritating and may stimulate a gag reflex. Size is adjusted by measuring (or comparing) the corner of mouth-earlobe or incisor-mandibular angle distance. Proper placement requires inserting the tube upside down and twisting it by 180 degrees to avoid pushing the tongue backwards. Easy and fast insertion makes it especially practical and gives rise to its use in operating theatres, emergency departments, and war zones [7].

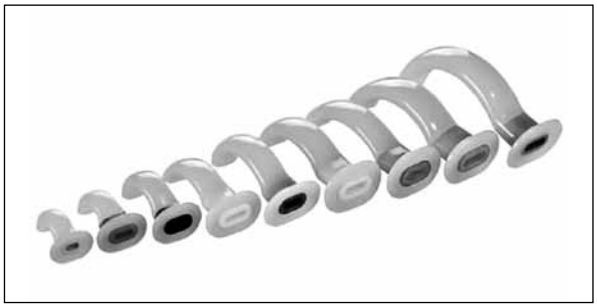

Fig. 4. Guedel airway (source: under courtesy of Sumi Ltd. www.sumi.com.pl)

3. Laryngeal mask – consists of a head with circumferential cuff, a tube, a pilot balloon, and proximal 15mm connector. May be single-use or reusable. Patient may breathe spontaneously or ventilation may be controlled (peak pressure up to 25-30cm H20). Applications include maintaining the airway in difficult intubations, emergency airway management in failed intubation, ensuring airway patency in unconscious patients, inhalational anesthesia, and CPR. Size is adjusted according to patient weight (1 – patients under 5kg, 5 – over 80kg; may slightly differ between manufacturers). It is important to note that the LMA does not protect from aspiration of gastric contents. Before insertion, the cuff should be lubricated and/or slightly inflated, then it is slid through the larynx. An LMA's aperture should face a laryngeal inlet or may be placed posteriorly and twisted towards the larynx once behind the tongue. Then, the cuff is inflated up to 60cmH2O. It is considered the fastest way to achieve airway patency. Currently, 2nd generation SAD (such as i-gel or Proseal) are recommended, especially for unexpectedly difficult intubations [8–14].
4. Tracheal tubes – used widely during endotracheal intubation. There is a huge diversity between types and sizes of ET tubes (reinforced, noncuffed, preformed, pediatric, double lumen). Standard, single-use tubes are made of PVC and have an inflatable cuff with a pilot balloon near the proximal end. Its distal end has a hole (called Murphy's eye) and a left facing bevel. The proximal end is equipped with a connector that allows quick linkage to ventilator tubing or a self-inflating bag.

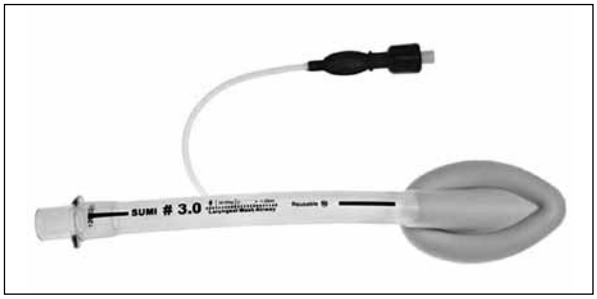

Fig. 5. Multi-use LMA (source: under courtesy of Sumi Ltd. www.sumi.com.pl)

Tubes are usually marked with manufacturer's name, size (ID – internal diameter) and distance from the tip in centimeters. Modern ones have also a radiopaque line incorporated for easy visualization on x-ray (Fig. 6, 7).

5. Tracheostomy tubes – similar to tracheal tubes, curved, with or without cuff, made of plastic or metal – types vary in certain features for different purposes (Fig. 8).
6. Combitube – this is a double lumen, double cuffed device which may be inserted blindly. Once in place, it is crucial to ascertain which lumen delivers proper lung ventilation. The Combitube is currently being replaced by laryngeal tubes, which have less complicated construction and are simpler in use.
7. Laryngeal tube – designed to be easily, blindly inserted into esophagus. It has only one lumen and two cuffs with only one pilot balloon (Fig. 9). These cuffs occlude the esophagus and pharynx, thus allowing ventilation while offering some protection against aspiration of gastric contents (Fig. 10). Used mostly in emergency settings and CPR [15].
8. Laryngoscopes – essential equipment needed to perform laryngoscopy and endotracheal intubation. Consists of a handle and a blade (Fig. 11). The latter vary in size and type (i.e. Macintosh, Miller, Magill, McCoy, Soper).
9. Bougie introducer (GEB) – flexible, can be bent into desired shape. It is inserted into the trachea, then the endotracheal tube is fed over it. After

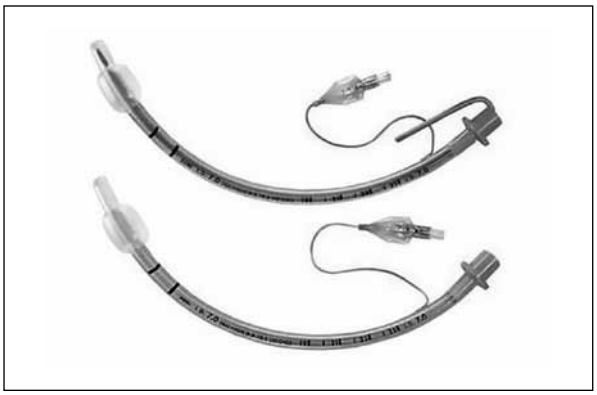

Fig. 6. Reinforced ET tubes incorporated for easy visualisation on x-ray (source: under courtesy of Sumi Ltd. www.sumi.com.pl)

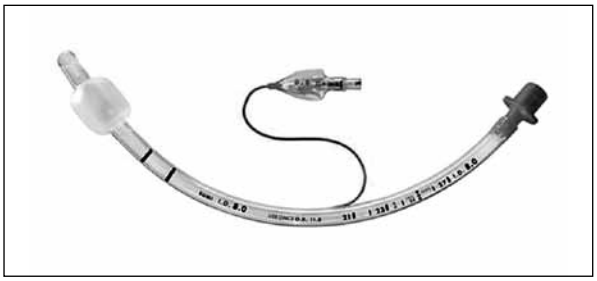

Fig. 7. Cuffed ET tube (source: under courtesy of Sumi Ltd. www.sumi.com.pl)

Fig. 8. Tracheostomy tubes (source: under courtesy of Sumi Ltd. www.sumi.com.pl)

Fig. 9. Cuffed LT tube (source: under courtesy of VBM Medizintechnik GmbH www.vbm-medical.de)

Fig. 10. LT tube positioning (source: under courtesy of VBM Medizintechnik GmbH www.vbm-medical.de)

Fig. 11. Laryngoscope

that, the introducer is removed. The GEB is an indispensable device for difficult tracheal intubations. It is also necessary (Fig. 12) for immediate front-of-neck access (Fig. 13) [12].

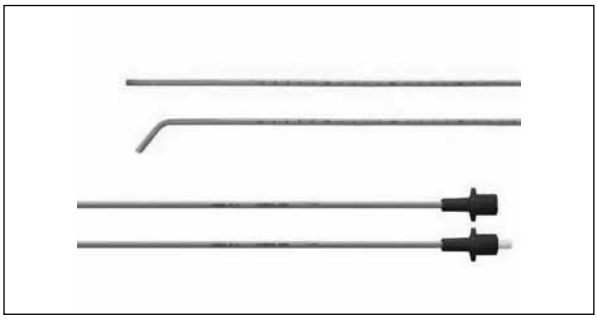

Fig. 12. GEB with ventilation lumen (source: under courtesy of Sumi Ltd. www.sumi.com.pl)

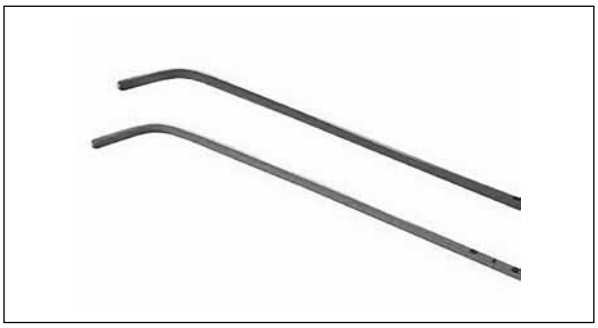

Fig. 13. Bougie introducer (source: under courtesy of Sumi Ltd. www.sumi.com.pl)

10. Tracheal catheter with ventilation lumen – similar to bougie introducer, allows oxygenation.
11. Suction equipment – indispensable instruments in ICUs, operating rooms, and emergency teams (usually as mobile devices).
12. Magill forceps – facilitates removing foreign bodies from an upper airway. Used in naso-tracheal intubation. Helpful when performing throat packing.
13. Stylets – flexible devices used usually as an adjunct to reinforced ET tubes (these are usually not rigid enough to insert into trachea)
14. Optical devices – i.e. fiberoscopes, videolaryngoscopes, optical stylets – these instruments are used especially when anticipating difficulties with a patient's airway.

Advanced airway management techniques are always (to variable extent) invasive. Procedures include using a combination of basic man oeuvres as well as instruments (described above). Some of them are complex and carry a risk of potentially fatal complications. Training and experience are needed to master them. Generally, advanced airway management procedures may be divided into supra- and infraglottic. Supraglottic techniques include inserting a nasopharyngeal airway, oropharyngeal airway, or laryngeal mask. Disadvantages of SAD include risk of aspiration, air leakage, and inspiratory peak pressure limits of approximately 20-25cm H_2O. Infraglottic advanced airway management consists of:

1. Tracheal intubation – defined as placing a tube in the trachea (via oral or nasal cavity). This is considered the most reliable way to achieve airway patency, providing satisfactory protection against aspiration of gastric contents. The indications to intubation include anesthetic – abdominal-, cardiac-, neurosurgery, protection against soiling, restricted access to neck and head during anesthesia; and non-anesthetic – such as CPR, respiratory failure, airway obstruction, unconsciousness, need for aspiration of tracheobronchial contents. During CPR and in the emergency setting (unconscious victim) it is usually performed without pharmacological preparation, while in the operating theatre intubation is carried out under general anesthesia (awake intubation is reserved for patients with known difficult airway) and optimal conditions – sniffing position, preoxygenation, patient paralyzed, with all the equipment (described above) prepared for potential emergencies (inability to ventilate and/or oxygenate). Following successful laryngoscopy, a tube (usually size 7-8mm ID in adults) is inserted between the vocal cords. Then, the cuff is inflated to a pressure of 20-30cmH20 and chest auscultation is performed, focusing primarily on presence of symmetrical breath sounds. If present, the tube is fixed and taped in position. These techniques require training and experience because intubations that are traumatic, prolonged, or failed and go unrecognized may lead to serious complications, such as hypoxaemia, hypercapnia, damage to teeth, mucosa, or larynx, bleeding, laryngospasm, cardiac arrhythmias, and/or hypertensive response [9].
2. Cricothyroidotomy – this is considered the fastest and most reliable way to gain airway access in case of emergency. The aim is to achieve lung ventilation as quickly as possible. The proper technique includes approaching a patient from the left side, identifying laryngeal anatomy (by a handshake), then specifically identifying the membrane between cricoid and thyroid cartilage using the left index finger. Subsequently, the stab incision is made with the right hand, followed by a 90-degree rotation of the blade. Once the opening is made, the bougie is inserted into the trachea and scalpel removed. The 6.0mm tracheal tube is railroaded over the bougie into the trachea – after that, the introducer is removed, ventilation confirmed and position fixed. This technique is described as "stab-twist-bougie-tube", recommended for all CICO (can't intubate, can't oxygenate) situations [11].
3. Tracheostomy – surgical technique, performed as an open or percutaneous procedure. A horizontal incision is made below the cricothyroid car-

tilage, then a vertical incision through the 2nd, 3rd, and 4th tracheal ring. The tube is inserted via a slit or circular opening in the trachea. Widely performed in ICU and palliative medicine to relieve airway obstruction, protect the tracheobronchial tree against aspiration, maintain patency when laryngeal reflexes are obtunded (vocal cords paralysis, neurological disease), or allow prolonged mechanical ventilation. Allows for easier nursing and increases patient comfort. Depending on underlying disease and general condition, patient may eat and speak with a tracheostomy tube [9].

Today, ABC principles are of fundamental importance not only for people working in health professions, but also among the non-medical population. Even younger children are taught the basics of first aid and their importance. Quick and proper management in life-threatening situations may be priceless in saving someone's life. Currently, awareness and knowledge about resuscitation, life support, and life-saving techniques are widely propagated among societies. Ideally, everyone should be familiar with basic life-saving procedures. Among medical professionals, there is an emphasis put on the mastery of ABC techniques. Airway management is the first step in the resuscitation algorithm. It consists of a variety of procedures, from simple and non-invasive, to more complex, requiring professional training and experience. At present, along with the development of evidence-based medicine, techniques which are proven to be clinically effective are regularly published in a convenient form - as bundles and guidelines. Regarding airway management, ERC and DAS guidelines are the most reliable and useful source of knowledge and practical clinical advice.

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Opinion papers

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THE CHALLENGING PATH TO ESTABLISH GENERAL PRACTICE IN AN ACADEMIC ENVIRONMENT – THE CASE OF THE CZECH REPUBLIC

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A – study design, **B** – data collection, **C** – statistical analysis, **D** – interpretation of data, **E** – manuscript preparation, **F** – literature review, **G** – sourcing of funding

ABSTRACT

The academic development of general practice (GP) within countries of Central and Eastern Europe began only after the political changes in the 1990s. From a research perspective GP has a reputation for being amongst the least intellectually rigorous clinical disciplines. This has several serious consequences; loss of self-confidence, lack of attractiveness as an intellectual discipline and less application of critical thinking in routine clinical work. The only solution is an effort to develop research in primary care, as this is the ultimate attribute of scientifically oriented disciplines such as medicine.

GP research in the Czech Republic has a low level of awareness and support. Its development is slow and faces many barriers; lack of financial resources, lack of leading personalities within the field, lack of ideas, lack of scientific education, lack of experience, and insufficient research capacity. As GPs, we do not have enough skills to write and publish scientific papers. Research is also not recognised as an essential component of GP training.

However, research in primary care is developing and here I present several successful research projects within our department. Research has been proposed as a vital agenda towards the new concept of general practice, as recently presented to the government by the Society of GPs.

KEYWORDS: primary care, general practice, research

Background

This article describes the path of general practice (GP) over the last few decades, with a special focus on the challenges, achievements and limitations of academic advancement in the Czech Republic.

At the beginning of 1980, when I started my GP training, the discipline was formally recognized but its reputation was poor, its scope of competencies was narrow and its function within the health care system was limited.

At the end of the 20th century, Central and Eastern European (CEE) countries experienced dramatic changes, including changes in health care. The opportunity to run private GP clinics increased its attractiveness. The role of GPs within the health care system has strengthened and their competencies have extended. The influence and support of the European Union to these countries has had an important effect, particularly in pushing their policies towards higher standards of family medicine. We grew up under the aegis of international projects, such as PHARE, the World Bank and the Norwegian Funds [1-2].

GPs suddenly faced many new perspectives and possibilities. We could travel to meet foreign colleagues, participate in courses and conferences, join WONCA networks, and participate in research and quality projects. We learned, absorbed and adopted ideas, knowledge and skills.

My academic career

I started my academic career at the Charles University in 2003. Similarly to other CEE countries, general practice was not traditionally recognised as an academic discipline. I soon learned how competitive the academic environment was and how difficult it was to assert oneself so had to adopt hard rules. I defended my thesis in 2007, completed the habilitation process and was appointed Head of the GP Department in 2009.

My team had to prove we were able to teach students and have a strong message for them, to organize our own research, publish papers in recognized journals, run international projects and also deliver high quality education for both future and established doctors.

We have received positive feedback from our students. Our teaching has been unique compared to hospital teaching in providing students opportunities to meet "naïve" patients and healthy people, and to assess problems rather than diseases. Students enjoy one to one teaching and the opportunity to learn how the GP department functions.

GP academic departments

GP academic departments play an important role in developing the discipline with scientific and professional organizations, as is the case in the Czech Republic. We have all put a lot of effort into enhancing the image and attraction of GP amongst other medical disciplines. We have worked on improving the undergraduate curriculum in GP, and have recruited GP-trainers who were able to give the best examples of good practice, based on their experience.

Research as an ultimate attribute of medical discipline

With regards to research, GP has a reputation for being among the least intellectually rigorous clinical disciplines. This has several serious consequences; loss of self-confidence, lack of attractiveness as an intellectual area and less application of critical thinking in routine clinical work. The best solution is an effort to develop research in primary care. Research is the ultimate attribute of all scientifically related disciplines and provides many opportunities for GP development. For example:

1. Primary care is often the least described aspect of the health care system, yet 70% of all clinical contact takes place in general practice. The health care system cannot be comprehensibly understood without data from primary care. GP research in this area may be contribute towards persuasive arguments for discipline leaders.
2. Research demonstrates the economic efficiency of primary care. General practice is a place of key decision-making on the provision of health services.
3. Research provides an opportunity to describe the importance of primary care through its activities in prevention, screening, early diagnostics, first line treatment and chronic disease management; all of which are of major economic importance.
4. Research helps GPs to connect with other medical disciplines.
5. GP research contributes to the development of medical science in a unique way.
6. GP research is necessary for the discipline's survival in a competitive academic environment and for establishing the posts we need [3].

Research in the Czech Republic

Currently, research in GP in the Czech Republic has a low level of awareness and support. Its development is slow and faces many barriers, similarly to other countries with a less developed GP research culture. We are have a lack of financial resources, lack of leading personalities within the field, lack of ideas, lack of scientific education, lack of experience, and insufficient research capacity. We do not have enough skills to write and publish scientific papers, and research is not recognised as an essential component of GP training, whereas it is in other countries such as Croatia.

GPs are not easy research partners as they are often busy and overwhelmed by clinical and organizational demands. Nowadays it is even more difficult to recruit GPs for research projects, even if fair funding is available. Gone is the time when good funding was enough to awaken the enthusiasm of colleagues.

Another problem is that the country needs simple implementation projects or local investigations that do not offer opportunities for international publications. Primary care in the Czech Republic is also more likely to research the process of providing services, education and quality rather than to perform clinical research. Opportunities to research in GP are with interdisciplinary projects, of which our institute has implemented a few in recent years; e.g. on colorectal carcinoma screening, measurement of peripheral pressure of the lower limbs and migraine management.

During the last few decades we also had the opportunity to participate in international research projects led by experienced academic centres, such as Utrecht, Oxford, Karolinska, etc.

We have experiences from international comparative studies and are aware of their pitfalls due to the diversity in health care system organization, methods of providing family medicine, payment systems, staff composition, interdisciplinary relations, cultural backgrounds and patient behaviours.

What should be done?

We need to promote research in general practice at the government level in order to establish a supportive funding policy. Research has been embedded as a vital agenda towards the new concept of general practice, as recently presented to the government by the Society of GPs.

The Czech GP Society will support delegates to EGPRN, the WONCA primary care research network[4]. The Society will provide spaces at conferences and a journal for presenting research projects from general practice. Specifically, a research project funded by the Society is being prepared for a group of Ph.D. stu-

dents on the subject of rural general practice. Research may also soon become a component of the postgraduate curriculum [5].

Departments should teach research skills and provide research opportunities in primary care for medical students, PhD students and established GPs, and to create, maintain and support GP research networks. We need young practitioners dedicated to GP and research. PhD students are required as drivers of research in universities and to become future academic leaders.

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NAVIGARE NECESSE EST! RESEARCH TO UNDERSTAND OUR BODY AND SOUL, TO HEAL THE PATIENTS, TO FIND OURSELVES

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A – study design, **B –** data collection, **C –** statistical analysis, **D –** interpretation of data, **E –** manuscript preparation, **F –** literature review, **G –** sourcing of funding

ABSTRACT

The image of a researcher is a distinguished, enthusiastic doctor in a fresh, washed and ironed white lab coat working in a clinic or research-centre. The research is well-financed, supported by different scientific and/or economic firms, and the aim is to understand the human body and its physiologic processes in atomic level for getting the best, mostly very expensive, and sometimes uneasy medical treatment for the patient.

Nowadays on top of the most modern sciences there is the specialist, who lives in an ivory tower and knows almost everything about diseases and sciences. Try to get off to this land!

KEYWORDS: research, everyday practise, physicians' experience, patients' wellbeing

Healing from the man to the man

First there was the wizard: an "erudite" man, one of the tribe's members. He lived amongst them, lived their life and tried to do his best to treat them with his knowledge.

During the millennia, curious, exploratory men have been discovering many facts, connections between illnesses and their treatments in the smallest details. The experienced wizard changed into the well-educated physician. He recognises a new problem, a new opportunity in the healing process, and tries to find new treatments, an exact description of the function of hormones, enzymes and different elements, to discover an important consequence or another cause of an illness.

But haven't we lost something during this very long and glorious development? Where is the man, where is the suffering patient? [1]. Try to find them!

The patients

Maybe they are in our village-practice, or in outpatient care, or in the local hospital of a small town. Within reach from us. They are living with us, in our settlement, in our neighbourhood suffering from symptoms; they are threatened by illness and await our help.

…And these suffering humans are our patients. We ought to help them, to cure them, to find the best solution for their problems.

But first we have to find the problem! To detect the deviation, to recognise the gap in the treatment process, and to improve the opportunities of healing. We have to seek better health promotion, for easier methods of health-restoration, and for perfect recovery.

Therefore, to argue our hypotheses we have to set up research. Try to make them!

The research

See what we are able to do to continually improve our daily work, and especially our patients' wellbeing.

Before all, we must first educate ourselves. This is not too hard nowadays. The Lancet, the Science, the British Medical Journal and of course Family Medicine and Primary Care Review(!), and a great many periodicals with high or lower impact factors are available in press or on the Internet.

However all the newest theories are less applicable without the patients' daily experiences. Patients are not machines and they don't step out from the best new medical book. They are individuals with their own strengths and weaknesses. It is useless if we know how to detect the blood sugar level with a different HgbA1, but we are not able to persuade the patient to adhere to a diabetic diet. Also, it is purposeless if we know the best micro-surgical procedure for intrauterine disorders,

but we are not able to convince women to undergo cervical cancer screening.

So, knowledge and experience together is most valuable. And how we can improve it?

By research. We can set up theories not only to find the sole sure therapy for cancer, but also on the "small" problems of everyday life.

How can we set up a good research proposal [2]? There are many of good descriptions how to write a research protocol [3–4].

Let us see what we can study: impact of complementary and alternative medicines [5–6], the effects of guide-lines, services within health care organizations [7]. We can study very important [8], or small things [9], any deviance we may detect amongst our patients. We can make a comparative assessment between nations, regions, genders, etc. [10–11]. We can research in the villages of Malawi [12], in the big cities of Japan [13] or in the state of Hungary [14]. Even our students [15]. can research during university.

We ought only to keep our eyes and minds open. To realise the problems which can be detected in our surgery/hospital department, and to always have great motivation to solve them to improve our work and support our patients' wellbeing.

Then we have to set up priority in the problems raised and choose the most important topic [16–17].

After we have determined the problem to be studied, we can read literature about it in the press or electronic literature. If we are lucky, we find not only good articles for and against in the overviewed papers, but also Meta-analyses.

The next step is selection of the population we are studying; sourced either only from our own practice, or from different practices altogether, or in comparison to the region, in the state or even internationally; and to confirm the exact inclusion and exclusion criteria.

The methods used in our investigations defines the research destination such as: to affirm a method, treatment or just to disprove it in a given population; to compare a treatment's effect with other populations; to make forward or backward revisions of morbidity, mortality, or treatment effects; or the most accepted and objective study: a randomized double-blind experiment.

If we have the proposal, we have to sanction the ethical background [18], and gain consent from the nearest university's ethical committee.

To help and support our colleagues, assistants are available during this elaboration process: sometimes by civil helpers [19] of NGO-s.

The final activity is the evaluation: to choose the best statistical method for our research, and use it to analyse the results and - if there are any - to compare our results with other national and international ones.

It is so simple, isn't it?

On the other side, there is no end of negative circumstances.

Sceptics say: it is only a small sample – but this doesn't matter [20]! For instance, Semmelweis discovered hand-washing with lime-chloride reduced mortality in the obstetric department of 30 patients in the St. Rókus Hospital!

Resistant colleagues also say: to detect the problems in a practice is only a statistic [21]. However, maybe it is the first step to resolving a huge problem!

Old doctors predicate: we do it always like this. Yes, in the ancient times early surgeons fixed all parts of abdominal-wall together after operations to deliver infant baby. However, except from some fortunate mothers – all these patients died. While one of the doctors after Ambroise Paré in the 16th century took the trouble to fix the fascia, the muscles, the fat tissue and the skin separately. Today mortality of Caesarean section is below one in ten thousand patients.

Einstein told: there are many things which are impossible to solve. Then somebody arrives, who doesn't know it, and solves the problem. Be you the unknowing explorer!

Human kind is not mathematics. We can describe all the physiological and pathological processes, but patients don't know the textbooks. We have to discover different deviations from the average and all their consequences – then resolve them in our practice! By these assessments, the hypothesis raised will improve our work and also give a basis to theoretical scientists to continue their studies.

WHO declaration describes, that health care is responsible for the patients' wellbeing in only 12%. But health care is responsible for this 12%! And if a practical physician recognises bias, a false result of a treatment, or an imperfect investigation, the responsibility is his/hers to discover it in every detail and publish it for all colleagues to further improve practice.

A far bigger obstacle is to obtain stakeholders' understanding and concordance [22]. But it may not be a problem for too long for an enthusiastic physician!

And what about the finances?

To find the problem, choose the study population, choose method for investigation and evaluation which needs no extra costs. Different investigations and treatments are part of our everyday work, only from another aspect, in other circumstances, for another part of population or for other prospects.

The high-budget studies are for an elaborate new pill, to make new (mostly expensive) investigations to detect its effects and side-effects, and to discover new elements of physiology.

However, our task as practitioners is to determine how to implement these in daily routine, improve our work with them, avoid harm to patients, and to prevent illnesses or complications.

In spite of these negative circumstances, there is our attitude: to help sufferers, to maintain the wellbeing of our patients, and to improve our medical service.

From this basis we shall discover all the positive effects, and without this attitude it is not worthwhile to engage in medicine!

There is the final task: we have found our patients, we know the importance of continual research, but where are we, ourselves? Try to rebuild!

The physician

A good physician does their everyday work with great responsibility, educates him-/herself to know every (?) new finding, new investigation, new method of treatment, and new change in legislation, administration and in the structure of health care. Besides the official tasks, a doctor fulfils all social expectations. GPs ought to be enthusiastic, emphatic, satisfied, keep smiling, always be quiet, transmit confidence and have great patience with patients.

It is told, if a GP achieves all these – it is for two persons! And if the expectation is also to research alongside all of the above, when is the time to live? Where is the private life? There will be no time for the household, to have intimate hours with the partner, for self-forgetting games with children, for careless entertainment with friends, for leisure time for hobbies and sports. There are many articles on the fact that if patients are well treated, they get perfect continual care and prevention, and they feel the empathy of medical stuff, then they need less time for health services [23–26].

So GP occurs in this service as a medicine.

What is the result? A well-managed practice, contented and not overworked doctor, and satisfied patients in good health [27]. Isn't it?...

Everybody has the opportunity to choose their directions, and to decide their route how to live his/her life engaged to patients. Engaged forever. Because it is our calling.

And we continue this spiral evermore.

This is called vocation. And a good physician can't do other.

...Never give up! Diligence, perseverance – and the investment will return to our advantage!

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EXPERIENCES OF A SLOVAK PHD PIONEER

Jana Bendova[A,B,D-F]

General practice for adults in Velky Biel, Slovakia

A – study design, **B** – data collection, **C** – statistical analysis, **D** – interpretation of data, **E** – manuscript preparation, **F** – literature review, **G** – sourcing of funding

ABSTRACT

It has all started 10 years ago, at my first WONCA Europe conference in Istanbul in 2008, where I became amazed by so many general practitioners, who performed and presented their scientific work there. However it took me 7 years since the idea to start my PhD studies until it´s final completion in 2017. My PhD journey wasn´t straight, but rather twisty, with 2 interruptions. In 2011 I started to earn my basic research skills at 2 courses. The first one was the European General Practice Research Network (EGPRN) course in Nice and the second University of Crete´s research workshop in Slovakia lead by Professor Christos Lionis.

The easiest part of my PhD studies was the clinical one – administering questionnaire and performing spirometry with my patients at my rural general practice. I also enjoyed teaching medical students at undergraduate as well as postgraduate level. I gave lectures at national conferences and published articles about general medicine in Slovak scientific journals, focusing on prevention, patient safety and respiratory diseases, especially COPD. I also contributed to two medical text books. My research was presented as posters or oral presentations at 3 WONCA Europe conferences, where I found a great space for sharing research ideas and results. Final results of my PhD thesis are going to be presented at Krakow conference.

Even though I was a fruitful author of publications, reaching the goal of an international publication was the most difficult part for me, not achievable without a help of experienced colleague, Austrian general practitioner, Professor Gustav Kamenski.

KEYWORDS: general practice, research, spirometry, COPD

Istanbul inspiration 10 years ago

It has all started 10 years ago, in September 2008 at the WONCA Europe conference in Istanbul. That was my very first WONCA conference. I was lucky to attend – it was my „reward" for participation at one of the first Slovak original researches performed by GPs in Slovakia – about Helicobacter pylori diagnosis and eradication treatment in general practices. I was amazed. Amazed by so many GPs, who performed and presented their scientific work. Who asked clinical questions and were looking for answers. It really opened my eyes.

Before I became a GP I used to work for an international contract research organisation as a clinical monitor, medical advisor and drug safety officer for phase I, II and III clinical trials. I have always been attracted to research. It also meant fun for me. Whilst working at this research company I started to miss the clinical part – the patients. So after a few years I returned to clinical medicine and opened my private general practice in a rural western Slovakia. However whilst working as a GP I missed the research part. From this point of view it was logical to combine research and general practice in one.

In Istanbul, in a discussion with my colleague Iveta Vaverkova, who is now Slovakia EURACT representative we started to design our first research project and in 2009 we undertook a pilot project about early detection of COPD in our 2 general practices. It got quite a lot of attention among our colleagues, but finally there was no publication as a result, as we didn´t know how to proceed.

EGPRN kick off

I became a member of EGPRN and attended the EGPRN Research Course in Nice in May 2011 „From the idea to detailed proposal" [1]. That exactly met what I needed. Working on my research question in detail under the leadership of Teresa Pawlikowska and Kristin Hendrickx I earned skills how to go further with my ideas:

- literature search
- how to formulate a good research question

– how to choose the appropriate method
– fundamentals in statics
and much more.

That course was an excellent balance between theoretical and practical learning with several didactic sessions followed by (so much appreciated) discussion.

University of Crete´s research workshop in Slovakia

In June 2011 The Slovak Society of General Practice in collaboration with the University of Crete organized an educational workshop for Slovak GPs. This workshop focused on research in general practice and was led by the Professor Christos Lionis, a leading general medicine researcher in Europe. I think everybody knows Prof. Lionis and his overwhelming energy. He is such an inspiration for all of us. He told me during that workshop „Jana, you´ll be the first professor of general medicine in Slovakia". I laughed about his idea - I had 2 little children and a busy rural practice. There was no place for such aspirations in my head at that time. But wise Prof. Lionis planted a tiny seed into my head...

Education about research was and still is lacking in Slovakia at graduate as well as postgraduate level. Research in general practice is unfamiliar to many GPs. It was therefore a great honour that Professor Lionis accepted our invitation to Slovakia to bring local research in primary health care closer to reality [2]. I don´t think anybody would ever forecast, that 5 out of all 10 participants will start PhD later on. Indeed, they did and I am the first one who completed it successfully.

An exotic PhD student

I bravely asked my former boss and a professor in pneumology Prof. Peter Krištúfek to be my PhD tutor. He was so surprised, as he has never heard about a GP PhD student. Neither have the members of entrance exams committee at the Slovak Health University in Bratislava. The professors wondered much about my motivation, but I was so contagiously enthusiastic about my research, that I got accepted. I was the first general practitioner ever accepted at PhD. A real pioneer, which I was proud of.

That was in 2010.

However it took me 7 years since the idea to start my PhD studies until it´s final completion in 2017.

Twisty path to PhD

My PhD journey wasn´t straight, but rather twisty. The clinical part of my research was the easiest one. I enjoyed it very much – administering questionnaire and performing spirometry with patients at my general practice. It was very rewarding – my patients became interested into my research and supported me much.

I had to learn from my own mistakes mainly. Due to work overload and marriage storm I interrupted my PhD studies twice. Except my tutor there has been another angel, who supported me and gave me power to carry on when I was nearly giving up - Jean- Marie Degryse from the Catholic University of Leuven. He offered me to come to his university and discuss my project among his colleagues in order to get my project further. I have never accepted his offer but for several years that feeling that I could do that anytime, when I stop seeing the light at the end of my PhD tunnel, comforted me.

Teaching and publishing

The great part of PhD is teaching and publishing. I love both. In 2014 I started to teach general medicine undergraduate medical students at Comenius University in Bratislava. The same year I also started to teach trainees in my general practice for 2 universities – Slovak Health University in Bratislava and Jessenius Medical Faculty of Comenius University in Martin. I published several articles in Slovak scientific journals and contributed to 2 undergraduate text books [3], [4]. I presented my several researches at national conferences as well as at 3 WONCA Europe conferences, in the form of posters or oral presentations [5]. WONCA conferences are a great place to share primary care research ideas and results. At the upcoming WONCA Europe conference in Krakow the final results of my PhD thesis are going to be presented as a poster.

International publication

The most difficult criterion to be fulfilled at my University was the international publication, of course. I think everybody has a huge respect in the front of international peer-reviewed journals. So had I. This respect was even paralyzing me. Even though I was very fruitful author at the Slovak national level I have to admit that without the help of Austrian general practitioner Professor. Gustav Kamenski I would have never succeeded to fulfil this criterion.

As Professor Kamenski performed research on the same topic as did I (COPD), he asked me to participate at his research paper creation. My role consisted of literature search and contribution to the discussion part. Our research paper has finally been published in BMJ Open in 2015 [6].

The future of general medicine research in Slovakia

A few months ago I learned that I´m an inspiration for 2 of my colleagues, who started their PhD journey

just recently. I do my best to help them, to advise them in order to avoid the mistakes I made. I very much hope that with my help their PhD journey will be smoother than mine.

Research in general medicine in Slovakia is still in diapers, having a lot of childhood diseases. It´ll take time until it grows up...

Conclusion

I like the quote "Every marathon begins with the first step..." I did the first step and had to concentrate on further thousands of steps, tripping sometimes over and getting up again. Today I am so happy that I got to the end of that marathon.

And actually I found out, that it´s not the end... it´s just a beginning of a new journey...

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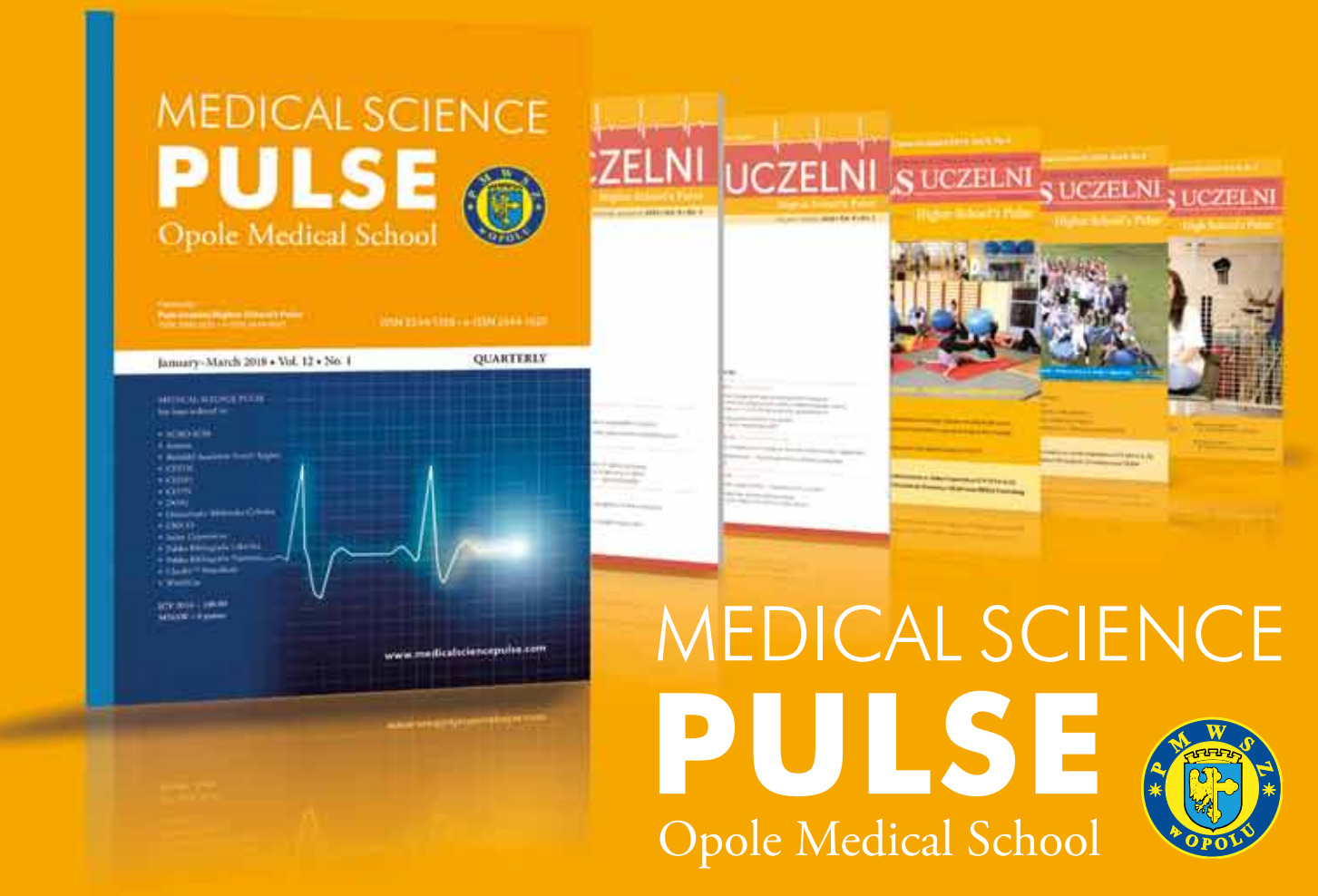

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