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DEVELOPING THE COMPETENCIES OF MEDICAL STUDENTS VERSUS THE CHALLENGES OF COORDINATED AND PERSONALIZED MEDICINE

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Purpose: The article discusses the specificity of coordinated and personalized medicine and the resulting demand for individual competences of medical graduates. Identification of the assumed knowledge, skills and professional attitudes of medical graduates is the main research goal.
Design/methodology/approach: Qualitative research was conducted by analyzing existing data (desk research): the standards of medical education set by the Ministry of Science and Higher Education and the planned learning outcomes at five leading medical universities in Poland were analyzed.
Findings: The analyzes carried out allowed us to determine the necessary competences are identified by health care specialists to perform medical professions. Education standards place little emphasis on the development of soft and organizational skills, which are necessary in the context of the development of coordinated and personalized medicine. Some universities independently expand learning outcomes with new technologies, protection of sensitive data, or analysis of large databases. The summary presents several key conclusions.
Research limitations/implications: The results of the presented research were based on document analysis, which does not allow for generalizations in the conclusions. It would be important to conduct quantitative research among students and lecturers regarding the effects achieved during professional practice classes.
Practical implications: The results of the analyzes lead to the conclusion that universities recognize the need to update the educational outcomes obtained during medical studies in terms of contemporary challenges, including aspects developing coordinated and personalized medicine. Conclusions may constitute recommendations regarding updating legal regulations of the Ministry of Higher Education.
Social implications: Implementing changes to medical curricula would better prepare graduates for the challenges of modern medicine and the diagnosis, treatment and care of patients.
Originality/value: The analyses carried out allowed the identification of the competences necessary for health care professionals to practice. The role of soft competencies in the delivery of health care services was indicated. In conclusion, some key conclusions were presented from the point of view of the assumptions of personalized medicine.

Keywords: individual competences, coordinated medicine, personalized medicine, medical students.
Category of the paper: Research paper

1. Current challenges in medicine – coordinated and personalized treatment

Pursuant to the Act of October 27, 2017, the primary care facility should provide comprehensive care in the area of primary health care for the patient, including, among others, conducting the treatment process and coordinating it, including referral to specialists or inpatient treatment (Bem, 2011; Sikorski, 2018; Primary Health Care Act, 2017).

Coordinated health care can help solve several basic difficulties with the effectiveness of the treatment process (Kardas, 2014) and coordination of activities between the doctor and specialists from other medical professions and between facilities become one of the fundamental challenges of global health protection (Sikorski, 2018). The next step in improving the coordinated treatment process should be personalized medicine, i.e. individualization of the patient's therapy process and adjustment of activities (personalization) taking into account the patient's potential (Barłóg, Barłóg, 2022; Gaciong, 2016; Jain, 2002; Kaleta, 2016; Wysocki, Handschuh, Mackiewicz, 2009).

Initiated changes in global medicine in the field of coordinated treatment and personalized will create the need for changes in the health care system. The need to introduce new solutions should be preceded by, among others: evaluation of the current organizational competences of the health care system and individual competences of specialists employed here, as well as the development of methods and techniques for eliminating possible competence gaps in the event of a mismatch between the current knowledge, skills and attitudes of health care specialists towards emerging new needs (Bing-Jonsson, Foss, Bjørk, 2016; Twarowski, 2011).

The article focuses on the specificity of coordinated and personalized medicine and the resulting demand for individual competences of medical graduates, as well as how it is met through formal education at leading Polish medical universities.

2. Acquisition of competencies and their development by future employees

Individual competencies are the dispositions of an individual leading to behavior consistent with the requirements of the job, and their high level enables the achievement of expected results at work (Rzempała, 2017; Szafrański, Mazur, Grzegorczyk, 2017). The structure of individual competences consists of knowledge, skills and attitude. An employee with high

competences therefore has theoretical knowledge, is able to use it practically and demonstrates appropriate attitudes both in the workplace and outside it (Bielińska, 2017; Rzempała, 2017; Wang, Olivier, Chen, 2020).

In the literature we can find a division of individual competences into behavioral, technical and professional (Rzempała, 2017; Wyrozębski, 2009). Behavioral competences refer to interpersonal issues, the area of cooperation, delegating tasks, and making key decisions. Technical competences concern knowledge of methods and techniques necessary to perform a specific profession and perform tasks specified for a given position in the organization. However, professional competences "these are the standards provided and expected for the fulfillment of designated tasks and activities in specific areas of work" (Armstrong, behind: Rzempała, 2017, p. 421). In another classification of competencies, they were divided into soft and hard. Soft skills refer to social and interpersonal issues, and hard skills refer to knowledge and substantive skills related to a specific profession (Gorustowicz, 2019; Salman, Ganie, Saleem, 2020).

The development of individual competences takes place through formal education (conducted by various institutions with an established education and certification program) and informal education, in which competences are acquired and developed through volunteering, participation in social communication or membership in organizations, e.g. non-governmental ones. The analyzes of the Polish labor market conducted by Zakrzewska (2014) lead to two key conclusions:

1. a high need for the development of soft skills in employees,
2. the development of soft skills takes place mainly through informal education, therefore informal education should be included in the formal education process.

However, these are universal data, it is worth taking a look at the specificity of a rather unique sector, such as health care.

3. Coordinated and personalized medicine – competence challenges for employees

From the perspective of the development of coordinated and personalized health care, interpersonal competencies of medical staff should be recognized among the key competencies, apart from professional and technical ones. In case of coordinated treatment and personalized, soft skills seem to be as important as hard skills (Barłóg, Barłóg, 2022, Bem, 2011). The soft skills of health care workers include interdisciplinary cooperation skills as well as understanding the expectations and emotional needs of patients and their family members (Małecki, 2018; Małecki, Nowina Konopka, 2018; Nowakowska et al., 2009). In long-term treatment, the specialist, in addition to focusing on physical health, should also take into account

the emotional needs of the patient and his family, adopting a partnership type of communication (Nowina Konopka, 2016). It is also important to adapt messages to the type of diagnosis or the patient's predispositions (Chapman, Roberts, Duberstein, 2011).

The described competence gap, i.e. the difference between the currently possessed communication competences of health care workers and the necessary level of these competences, seems to be increased by inappropriate working conditions of specialists, e.g. regarding the time allocated for a visit to one patient (Karkowski, Karkowska, Skoczylas, 2016).

Among the hard skills of coordinated medicine and personalized, knowledge and skills in the area of diagnosis and treatment, including the methodology of conducting genetic tests, should be taken as a foundation (Chan, Ginsburg, 2011; Hamburg, Collins, 2010, Gaciong, 2016; Schork, 2015). Organizational skills are also key, including those related to the management of sensitive data, of which there is significantly more in the case of personalized medicine (compared to traditional treatment) (Barłóg, Barłóg, 2022; Chan, Ginsburg, 2011; Hamburg, Collins, 2010, Gaciong, 2016; Schork, 2015). A review of the literature on personalized medicine also leads to the conclusion that there is a need for high competences in the area of use from new technologies (Abul-Husn, Kenny, 2019; BG, Mehrotra, Marques, Kumar, Verma, 2023; Lam, Yu, Zhu, Wang, 2023; Serrano et al., 2023; Shopova et al., 2023), as well as within the scientific analysis of many medical and statistical data (Cirillo, Valencia, 2019; Suwinski et al., 2019; Senn, 2018).

A review of previous research shows that medical staff are highly motivated to develop individual competences (Bielawska, 2012; Karnej, Łyś, Grzebieluch, 2012), therefore it is worth considering which of them are particularly developed during studies.

4. Own research methodology

Subject and purpose of research

The subject of the research were the educational standards set by the regulation of the Minister of Science and Higher Education, preparing to practice as a doctor, and the planned learning outcomes in medicine at 5 leading medical universities.in Poland. A review of education standards and learning outcomes may be the basis for determining what necessary competencies to perform medical professions are identified by health care specialists. Identification of the knowledge, skills and professional attitudes of medical graduates assumed within the educational standards is the main research goal of the presented study. At the same time, it will be analyzed to what extent the assumed learning outcomes relate to key individual competencies. Analysis of the study program in terms of not only individual competences,

but also equipping graduates with knowledge and skillsand attitudes useful for the implementation of organizational competences of the health care system is necessary because the management of public health care competences should be carried out by improving social capital, taking into account modern, up-to-date management concepts: the concept of comprehensive quality management TQM; the concept of building organizational culture and organizational learning and knowledge management (Sitko-Lutek, Pawłowska, 2011). Each of these concepts assumes the active involvement of employees in building the culture of the organization, using their knowledge and skills for this purpose. In a similar way, social capital needs to be managed in the health system, so the area relating to individual competences will be analysed, consisting of: behavioural (soft skills), technical (hard skills), professional (hard skills) (Rzempala, 2017; Wyrozebski, 2009).

The main research question is therefore as follows: what learning outcomes in the area of knowledge, skills and attitudes are specified in the educational standards in medical fields specified by the Ministry of Science and Higher Education and in the study programs of leading medical universities in Poland? An additional research question is to what extent do the assumed learning outcomes relate to individual soft (behavioural) and hard (technical and professional) competences? As the study is exploratory in nature, no hypotheses were formulated, limiting itself to two main research questions.

Research sample

The study was conducted by analyzing existing data (desk research). The following materials were included in the research:

- Regulation of the Minister of Science and Higher Education of July 26, 2019 on standards of education preparing for the profession of doctor, dentist, pharmacist, nurse, midwife, laboratory diagnostician, physiotherapist and paramedic.
- Regulation of the Minister of Science and Higher Education of September 29, 2023 amending the regulation on standards of preparatory education to practice as a doctor, dentist, pharmacist, nurse, midwife, laboratory diagnostician, physiotherapist and paramedic.
- Learning outcomes planned for the medical field. A review of the learning outcomes of leading Polish universities (in the area of teaching in the field of medicine) was conducted, based on the 2023 ranking created by the "Perspektywy" educational portal.Those universities that made their full study program available on the Internet were taken into account with planned learning outcomes. In this way, the following were taken into account in the analysis: Jagiellonian University (1st place in the ranking); Wroclaw Medical University (3rd place in the ranking); Medical University of Lodz (4th place in the ranking); Pomeranian Medical University in Szczecin (6th place in the ranking); Medical University of Bialystok (7th place in the ranking).

5. Research results

Education standards

The current educational standards for medical faculties are set by a decree of the Minister of Education and Science dated September 29, 2023. According to it, no less than 5700 hours of classes, including professional practice, are implemented in the medical faculty. The aforementioned regulation distinguishes 9 groups of classes. Based on the number of hours planned by the Ministry, the percentage share of each category of classes in the 6-year cycle of education in the medical faculty was calculated. A detailed summary is shown in Table 1.

Table 1.
Minimum number of hours of classes and ECTS points in the field of medicine

Groups of classes in which specific learning outcomes are achieved	Number of hours	Number of points ECTS	Percentage of classes in the study program
A. Morphological sciences	270	20	5,24
B. Scientific basis of medicine	465	35	9,03
C. Preclinical sciences	525	40	10,19
D. Behavioral and social sciences with elements of professionalism	240	18	4,66
E. Clinical non-surgical sciences	1120	70	21,75
F. Clinical treatment sciences	940	55	18,25
G. Legal and organizational aspects of medicine	90	6	1,75
H. Practical clinical teaching (30 weeks) and examinations	900	60	17,48
I. Professional practice (20 weeks)	600	20	11,65
Total	5150	324	100 %

Source: Regulation of the Minister of Science and Higher Education of September 29, 2023, p. 3.

Compared to the regulation of the Minister of Science and Higher Education of 2019, the number of hours and the number of ECTS points in five groups of classes have changed: A, B, E, F, G. In morphological sciences the number of hours was reduced by 30, in the scientific basis of medicine it was reduced working hours: 60, in the legal area and organizational aspects of medicine, 10 hours were subtracted, but their number was increased in the group of non-surgical clinical sciences - by 80 hours, as well as clinical procedural sciences by 40 hours. This means a shift in the number of hours towards hard skills. Taking into account the current number of hours assigned to individual groups of classes, non-procedural and procedural clinical sciences and preclinical sciences, as well as practical teaching, are key. The least time is devoted to the development of social competences in the area of behavioral and social sciences (group D), as well as in law and organizational aspects of medicine (group G). In behavioral and social science classes, learning outcomes address issues of physical, emotional, cognitive, and social development; influence of the social environment (family, work, social relations) on health and illness, motivation of the patient by the doctor, working with own and the patient's stress, developing communication competences (empathy, emotional intelligence, coherence between verbal and non-verbal communication),

cooperation with the patient's family and the area of preventing violence, addictions, as well as the development of ethical attitudes towards the patient and his family. According to the regulation, 4.66% of teaching hours are devoted to these effects. Therefore, the standards of education in medicine include less than 5% of classes devoted to the development of behavioral competences and soft skills; this group of classes also includes hours devoted to teaching English. According to the regulation, no more than half of the hours may be devoted to teaching English. If the university plans 120 hours of English classes, 2.33% of classes planned in the education cycle will be devoted to classes devoted mainly to soft skills. Of course, not only subjects from group D prepare students to achieve learning outcomes in the area of behavioral competences. For classes in groups D, E and F, 120 hours are allocated for classes in simulated and clinical conditions, but these classes can be carried out for groups of at least two fields of study (Regulation of the Ministry of Education and Science, 2023). The next step in the research procedure was to analyze the number of learning outcomes planned for individual groups of classes. It was also calculated how many hours a student has on average to master one learning outcome. The more hours of classes are planned, the more learning outcomes are assumed. Medical students have the most time to master competences in the area of morphological and clinical sciences, and the least timeto develop interpersonal competences and ethical attitudes (group D) and legal and organizational aspects of medicine (group G).The results are presented in table 2.

Table 2.1
Number of learning outcomes assigned to each group of classes

Groups of classes in which specific learning outcomes are achieved	Knowledge	Skills	Total	Average number of hours to master 1 learning outcome
A. Morphological sciences	4	4	8	33.75
B. Scientific basis of medicine	26	12	38	12.24
C. Preclinical sciences	43	13	56	9.38
D. Behavioral and social sciences with elements of professionalism	20	14	34	7.06
E. Clinical non-surgical sciences	42	34	76	14.74
F. Clinical treatment sciences	23	22	45	20.89
G. Legal and organizational aspects of medicine	22	11	33	2.73
H. Practical clinical teaching (30 weeks) and examinations	-	44	44	20.45
I. Professional practice (20 weeks)	-	-	-	

Source: Regulation of the Minister of Science and Higher Education of September 29, 2023.

Then, the planned general learning outcomes in the medical field were analyzed, assigning the outcomes to one of two groups of competencies: soft or hard. Out of 25 planned learning outcomes, 12 (48%) of them refer to hard skills and 13 (52%) of them to soft skills (details are presented in table 3), 19 learning outcomes definitely concern the employee's know-how , and only 6 learning outcomes address the issue of organizational competences, which to some extent touch on the issues of external cooperation skills, creating a team mind, building the organization's reputation, or commitment to the organization and the ability to implement

new solutions. These 6 effects are as follows (Regulation of the Minister of Science and Higher Education of September 29, 2023):

1. *ethical, social and legal conditions for practicing the medical profession and the principles of health promotion, and bases his knowledge on scientific evidence;*
2. *inspire the learning process of others;*
3. *communicate with the patient and his family in an atmosphere of trust, taking into account the patient's needs, and convey unfavorable information, applying the principles of professional communication;*
4. *communicate in the team and share knowledge;*
5. *establishing and maintaining deep and respectful contact with the patient, as well as showing understanding for ideological and cultural differences;*
6. *formulating conclusions from your own measurements or observations.*

Education standards also present key learning outcomes in the area of knowledge and skills for individual groups of classes. There are 183 learning outcomes planned in the knowledge area, and 110 in the skills area (for class groups A-G, for the group H, 44 skill learning outcomes were planned). Learning outcomes in the area of social competences were left only at the level of these general 11 outcomes.

Learning outcomes at medical schools

The standards for medical education outlined in the regulation of the Ministry of Science and Higher Education specify how 5150 hours will be implemented, leaving universities to plan a minimum of 550 hours of coursework and additional learning outcomes. The current study programs are still based on the 2019 regulation, as the 2023 regulation was published just before the start of the academic year. Three of the five universities analyzed base their study programs on the learning outcomes outlined in the ministerial regulation. One of the universities (Medical University of Bialystok) additionally dissected the planned learning outcomes for class group H, i.e. practical clinical teaching. Jagiellonian University expanded the number of learning outcomes presented in the standards. The differences are bolded in Table 3.

Table 3.
Number of planned learning outcomes in the area of knowledge and skills in the medical faculty of each medical university

Learning outcomes: knowledge								
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Wroclaw	6	29	51	23	43	16	18	-
Lodz	6	29	51	23	43	16	18	-
Cracow	6	**50**	**58**	**24**	**58**	**21**	**23**	-
Szczecin	6	29	51	23	43	16	18	-
Bialystok	6	29	51	23	43	16	18	**37**

Cont. table 3.

Learning outcomes: skills								
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Wroclaw	5	13	20	18	38	26	9	-
Lodz	5	13	20	18	38	26	9	-
Cracow	5	**31**	20	**22**	**51**	**36**	**13**	-
Szczecin	5	13	20	18	38	26	9	-
Bialystok	5	13	20	18	38	26	9	**28**

Source: study programs and documents of selected universities.

Next, an analysis was made of what additional learning outcomes were planned at the universities of in Bialystok and Krakow, since at the other universities only learning outcomes consistent with the Ministerial Decree are planned. From the area of learning outcomes for class group H, at the Medical University of Bialystok, 6 of the 37 learning outcomes in the knowledge area do not directly relate to hard competencies in the medical area, and of the 28 learning outcomes in the skills area, 9 of them go beyond hard medical competencies. At Jagiellonian University, the added learning outcomes, in addition to hard medical competencies, relate to knowledge of information technology, the ability to create databases and analyze them, including genetic data, and protection of sensitive data.

Table 4.

Additional learning outcomes in the medical field planned by the universities

Medical University of Bialystok	**Jagiellonian University**
Learning outcomes, in terms of knowledge. The graduate knows and understands	
1. knows the principles of working with word processors, preparing presentations, knows the basic techniques of creating websites 2. knows the basics of computer networks 3. knows the principles of protection of intellectual property or content related to copyright protection 4. the student is familiar with the concepts, health and safety regulations and regulations of the university concerning occupational safety and health. 5. understands the importance of physical activity in the prevention of health and in the exercise of the medical profession 6. has knowledge of the social and educational functions of physical activity in preparing a person for recreation and work	1. techniques of presenting data online 2. principles of using materials published on the Internet (copyright, the right of quotation, ways to obtain free materials 3. ways of safe Internet communication 4. ways of computer support of medical decisions with particular emphasis on the technique of clinical pathways 5. basic techniques of medical knowledge representation for intelligent computer systems in medicine 6. concepts related to online data transmission 7. elements of a hospital patient service system 8. selected online sources of medical information with particular emphasis on genetic diseases 9. principles of operation and organization of teleconferencing 10. types of IT tools supporting the process of remote continuing education with particular emphasis on simulators available online 11. opportunities and limitations created by new computer simulation techniques on the examples of selected European research projects 12. types of data used in electronic medical records 13. principles of creating databases for patient care and research purposes 14. principles of operation and use of the electronic patient record 15. standards relating to patient rights 16. health effects of systematic physical activity of children and adolescents and physical activity of adults in the prevention of selected diseases 17. situations in which there are conflicts between values and principles from

Cont. table 4.

Learning outcomes,in terms of skills. The graduate can:	
1. is able to use historical knowledge in the evaluation of modern medicine; 2. is able to forecast the development of medicine; 3. is able to recognize the continuity of medical thought in terms of the progress of medical science and interdisciplinary connections; 4. is able to recognize factors shaping the development of medicine; 5. is computer literate in word processing, graphics, preparation of presentations, working with spreadsheets and the Internet; 6. Able to prepare and deliver a short presentation on professional topics; 7. Able to organize social support for the patient and his/her family; 8. is able to find relevant legislation containing standards for the provision of health services and the practice of medicine. 9. Has the ability to effectively and skillfully perform the basic elements of technique of selected sports and recreational activities.	1. assess the reliability of a clinical trial 2. understand the concept of meta-analysis and how to present its results 3. use online libraries of images, audio and video recordings 4. use equipment for playing three-dimensional video images 5. use online databases of the human genome 6. use online databases of genetic disease entities 7. use a telemedicine tool for teleconsultation purposes 8. use various types of computer simulators and e-learning tools for educational purposes with special emphasis on virtual patients 9. use computer simulators to support medical decision making 10. represent expert knowledge using simple computerized knowledge representation techniques such as a block diagram or rule base 11. secure clinical data from unauthorized access 12. use e-learning platforms 13. prepare materials for online presentations

Source: study programs and documents of selected universities.

6. Conclusions

The research carried out made it possible to answer the research questions posed. The learning outcomes defined in the educational standards for the medical faculty mainly refer to knowledge and skills, there are almost 300 of them, while social competencies are devoted to 11 outcomes. Teaching in the medical faculty focuses on hard competencies that relate directly to health and illness. There is little focus in the educational standards on hard competencies relating to coordinated and personalized medicine. The standards devote only 5 outcomes to ICT issues. Modern medicine requires hard competencies in the area of sensitive data management (Chan, Ginsburg, 2011; Hamburg, Collins, 2010, Gaciong, 2016; Schork, 2015) handling new technologies (Abul-Husn, Kenny, 2019), statistical, clinical and genetic data analysis skills (Cirillo, Valencia, 2019; Suwinski et al. 2019; Senn, 2018). It is worth noting, that the additional learning outcomes planned by two of the five medical universities analyzed address these issues. Thus, the various medical universities note contemporary trends in medicine, the need to develop competencies to enable the development of coordinated and personalized medicine.One of the basic competence gaps in Polish health care is both external and internal communication (Borek, Kilijanek-Cieślik, Perendyk, Sitek, Wojtaszczyk,

2017; National Health Fund 2016). Patients complain about contact with facilities (long queues, lack of modern forms of contact), but also about the interpersonal skills of specialists (including issues of building relationships or translating medical recommendations) (Sulkowska, Milewski, Kaczorowska-Bray, 2018).

According to the standards, content related to communication and interpersonal competences covers less than 5% of university classes, including learning English, so in reality less than 3% of classes are directly devoted to ethics and social competences. The timetable itself shows future graduates that this is a marginal issue in their work. In coordinated and personalized medicine, interprofessional cooperation of health care specialists is important (Barłóg, Barłóg, 2022). Educational standards enable interdisciplinary cooperation in practical classes, in simulated or clinical conditions. This is a particularly important aspect because soft skills are acquired mainly in the form of informal education, volunteering or professional internships (Zakrzewska, 2014), and these include a minimum of 1,500 hours in the study plan (classes from groups H. and I), which means minimum 26.32% of all classes during studies. However, the extent to which professional internships develop students' soft skills requires empirical verification. Therefore, it seems interesting to conduct research among final-year medical students and recent graduates.

To sum up: Learning outcomes in the medical field focus on hard competencies. Classes devoted directly to the development of soft skills constitute up to 5% of all classes during studies. Perhaps the development of soft skills occurs during 1,500 hours of practical classes, but this hypothesis requires empirical verification. The learning outcomes presented in the education standards to a small extent relate to the challenges of coordinated and personalized medicine. Selected universities recognize the directions of changes in medicine, adding learning outcomes in the area of sensitive data protection, analysis of scientific and genetic data, or statistical analysis, however, the number of effects regarding interprofessional cooperation between health care specialists should be increased.

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