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## TRANSFORMATIONS OF THE DENTAL INDUSTRY DURING THE PERIOD OF INDEPENDENCE OF UKRAINE AND THEIR IMPACT ON THE AVAILABILITY OF DENTAL CARE

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**Abstract.** *Transformations of the dental industry during the period of independence of Ukraine and their impact on the availability of dental care. Mazur I.P., Lekhan V.N., Rybachuk A.V. The article presents an analysis of the transformations of the dental industry in different periods of development of the health care system from 1991 to 2020 and their impact on the availability of dental care. The materials of the study were regulations, statistics on the infrastructure and human resources of the dental industry in Ukraine. Bibliosemantic, historical, analytical, medical-statistical and biostatistical research methods are used. The article presents an analysis of the number of dental institutions and dentists per capita at different stages of development of the health care system of Ukraine. The transformation of Ukraine's health care system in 2015-2020 has led to a significant reduction in dental clinics and human resources in the Ministry of Health of Ukraine with a significant increase in the number of private clinics and dentists providing dental care. The share of working dentists in the public health relative to the private sector is declining: in 2017, 72% worked in public institutions and 28% – in private institutions; in 2020 – 59.7% and 40.3% respectively. Ukraine has a developed infrastructure and human resources for dental care. The transformation of the health care system leads to a reduction in the number of dental facilities and staff in the system of Ministry of Health, which is not offset by the intensive development of the private sector and reduces the availability of dental care. The introduction of innovative technologies increases the complexity of the work of dentists and, accordingly, requires an increase in the number of dentists. The policy in the field of dental education does not allow to prepare a sufficient number of dentists for the industry and to compensate for migration processes of labor dental potential to European countries.*

**Реферат.** *Трансформації стоматологічної галузі за період незалежності України і їх вплив на доступність стоматологічної допомоги. Мазур І.П., Лехан В.Н., Рыбачук А.В. В статті представлено аналіз трансформацій стоматологічної галузі в різні періоди розвитку системи охорони здоров'я з 1991 по 2020 рік і їх вплив на доступність стоматологічної допомоги. Матеріалами дослідження послужили нормативно-правові акти, статистичні дані про інфраструктуру і людські ресурси стоматологічної галузі в Україні. Використано бібліосемантичний, історичний, аналітичний, медико-статистичний і біостатистичний методи дослідження. Проведено аналіз забезпеченості*

стоматологическими учреждениями и врачами-стоматологами на разных этапах развития системы здравоохранения Украины. Трансформация системы здравоохранения Украины в 2015-2020 годах привела к значительному сокращению стоматологических учреждений и человеческих ресурсов в системе МЗ Украины при значительном увеличении количества частных клиник и стоматологов, оказывающих стоматологическую помощь. Доля работающих стоматологов в государственном секторе здравоохранения по отношению к частному сектору сокращается: в 2017 году 72% работали в коммунальных учреждениях и 28% – в частных учреждениях; в 2020 г. – 59,7% и 40,3% соответственно. Таким образом, трансформация системы здравоохранения приводит к сокращению количества стоматологических учреждений и персонала в коммунальном секторе, которое не компенсирует интенсивное развитие частного сектора, уменьшает доступность стоматологической помощи. Внедрение инновационных технологий увеличивает трудоемкость работы стоматологов и соответственно требует увеличения численности врачей-стоматологов. Политика в области стоматологического образования не позволяет подготовить достаточное количество стоматологов для отрасли и компенсировать миграционные процессы в европейские страны трудового стоматологического потенциала.

At the time of gaining independence in Ukraine in 1991, a powerful extensive system of providing medical dental care to the population was functioning, with a network of treatment and preventive facilities and hospitals being provided with professional personnel potential. Dental care was provided in the network of health care facilities (HCF), subordinated to the Ministry of Health of Ukraine, departments and other Ministries (Defense of Ukraine, Infrastructure of Ukraine, etc.), in scientific institutions of the Academy of Medical Sciences of Ukraine (Odesa scientific research institute and others) [4].

During three decades, the political vector of the state's development, economy and Ukrainian society changed. The main basis for the development of the health care system of the population of Ukraine is the implementation of the main provisions of the Constitution and laws of Ukraine regarding the provision of affordable qualified medical care to every citizen of Ukraine. The last ten years were characterized by radical processes of healthcare transformation, the introduction of new mechanisms of financing and management of the industry capable of providing medical care for all citizens of Ukraine at the level of developed European states and oriented to the patient [5, 17]. Significant changes also took place in the dental field. The dynamic development of dentistry, innovative technologies, their implementation in practical health care [13], on the one hand, and increasing patient requirements for the aesthetic component of dental services focused on high-value technologies, on the other hand, all this led to a situation when the state was unable to fully finance the dental industry. The further development of the state sector of stomatology was held back by the organizational and legal form of stomatological state (municipal) institutions and the need to define a guaranteed level of providing free qualified medical stomatological care in the amount determined by legislation [5, 6].

At the same time, the private sector in dentistry is developing actively – dental offices and polyclinics providing highly specialized dental care are being created [13]. The implementation of new high-cost technologies in private institutions is paid for by the solvent part of the population, which significantly reduces the pressure on financing of health care by the state. In market conditions, the use of high-level medical technologies increases the competitiveness of private institutions and significantly limits communal ones, the latter due to chronic underfunding are unable to purchase modern materials, suffers wear of equipment and medical personnel lack motivation to acquire new knowledge [13].

In view of the high rates of dental morbidity and the need for prosthetics, such issues as the coverage of affordable dental care for Ukrainians [13], especially privileged categories of the population, and the compliance of the existing infrastructure of the dental industry and human resources with the needs remain relevant.

The purpose of the study is to analyze the transformations of the dental industry in different periods of the development of the health care system from 1991 to 2020 and their impact on ensuring the needs of Ukrainians with affordable dental care.

#### MATERIALS AND METHODS OF RESEARCH

The analysis and comparison of statistical data on the infrastructure and personnel potential of the dental sector of health care of Ukraine by the periods of the reform of the health care system of Ukraine was carried out.

In the analysis of dental care in different periods, periodization of transformations in the health care system of Ukraine, taking into account the filling of reforms with relevant regulatory and legal documents in different periods and the effectiveness of changes proposed by Lekhan V.M. and coauthors [3]: at the first stage (1991-2000), reforms in the field of health care were practically not carried out and were aimed at preserving the network of

medical and preventive facilities and hospitals formed during the Soviet era, ensuring the minimum level of social guarantees and medical care for the population. At the second stage (2000-2010), the main directions and mechanisms of health sector reform were defined [3]. Implementation of a comprehensive reform of the medical care system at the third stage (2010-2013) and transformation of the health care system at the fourth stage with a change in the financing of the industry.

The research materials were data from the State Statistics Service of Ukraine and the Center for Medical Statistics of the Ministry of Health of Ukraine (State Statistics Service of Ukraine – <http://www.ukrstat.gov.ua/>; Center for Medical Statistics of the Ministry of Health of Ukraine – <http://medstat.gov.ua/ukr/statdanMMXIX.html>), normative and legal acts – Decrees of the President of Ukraine, laws of Ukraine, orders of the Ministry of Health of Ukraine (Legislation of Ukraine – <https://zakon.rada.gov.ua/laws>; normative and directive documents of the Ministry of Health of Ukraine – <https://mozdocs.kiev.ua/>), etc.

Bibliosemantic, historical, analytical, medical-statistical and biostatistical research methods were applied. Statistical analysis using the STATISTICA 6.1 package (StatSoftInc., Serial No. AGAR909E415822FA) included the calculation of means (M), relative values (intensive, extensive, visibility), confidence intervals (CI), the assessment of the reliability of their differences using the Pearson chi-square test and t -Student's criterion, Spearman's correlation coefficients (r); construction of trend line diagrams, the type of which was determined by the features of the data, with an assessment of the reliability of the approximation (R2), which reflects the closeness of the trend line value to the actual data. The critical value of the level of statistical significance was taken at the level of  $p < 0.05$  (5%).

The work has a positive response from the bioethics commission regarding the research methods used (protocol of the meeting of the commission on biomedical ethics of the P.L. Shupyk NUOH of Ukraine No. 9 dated 09/06/2021).

## RESULTS AND DISCUSSION

An analysis of dental care at various stages of the development of the health care system of Ukraine was carried out.

At the first stage of reforms (1991-2000) in the field of health care and against the background of the economic crisis in the country, the number of health centers of the Ministry of Health of Ukraine that provide dental care practically did not change. The number of dental offices and departments

organized in the medical and sanitary units at the enterprises is decreasing. Powerful city and regional independent dental polyclinics continue to operate in large cities. Self-supporting conditions are being introduced for the provision of dental care. A number of legislative acts are adopted regarding the provision of dental care to privileged categories of the population (veterans, pensioners, disabled people, victims of Chernobyl, etc.) at the expense of the state budget.

During the second stage of reform (2000-2010), the stabilization and gradual growth of the economy of Ukraine had a positive effect on the dental industry. In dental polyclinics and departments, their material and technical equipment is being modernized, new technologies are being introduced in the diagnosis, treatment and prevention of major dental diseases. The use of complex innovative technologies significantly increases the time of receiving patients, increases the complexity and intensity of the doctor's work, and, therefore, the qualification requirements for doctors increase. The introduction of innovative technologies and their constant updating leads to increased specialization among dentists. In the dental industry, there is a significantly smaller number of doctors of retirement age compared to other medical specialties: the specific weight of doctors of retirement age working in the industry in 2010 was 10.29% [13].

In order to reduce the dental morbidity of the population in Ukraine, the Decree of the President of Ukraine dated May 21, 2002 No. 475/2002 "On the Program for the Prevention and Treatment of Dental Diseases for 2002-2007" approved a set of measures for the widespread implementation of communal prevention measures, new organizational and treatment technologies in the activity of dental institutions [11]. Pursuant to the Decree of the President of Ukraine, the Ministry of Health of Ukraine approved order No. 272/58 of 18.07.2002 "On the approval of the Plan for the implementation of measures to ensure the implementation of the Program for the prevention and treatment of dental diseases for 2002-2007". The program for the prevention of major dental diseases provided for the improvement of the provision of dental care and the introduction of primary and secondary prevention of dental diseases, approval interdisciplinary approaches to solving problems that arise during the provision of dental care. Allocation of budget funds was planned for the implementation of the Program's activities. In order to improve the quality of dental care, in 2004 the order of the Ministry of Health of Ukraine No. 566 approved clinical protocols for the provision of medical care [10].

Large-scale multifaceted transformations in the field of health care at the third stage – in 2010-2013 also affected the dental field. Dental care was assigned to the second level of medical care. The reduction of the network of dental institutions and departments took place against the background of maintaining the estimated funding of health care facilities and the infrastructure of the system. Together with the reorganization of polyclinics into primary health care centers, dental departments, which were financially expensive for the institution's budget and required capital investments for renewal and modernization were closed. In rural areas, the tendency to reduce dental offices in outpatient clinics and to eliminate dental offices in villages intensified. If in 2011 the number of institutions with dental departments was 4,336, in 2012 – 3,902 (a decrease of 10%; 95% CI 9-11%), then in 2013 their number was almost halved (compared to 2011 by 47.7%; 95% CI 46-49%) and amounted to 2,277 healthcare institutions of the Ministry of Health of Ukraine. The number of independent dental polyclinics decreased by 6.7% (95% CI 4-10%) from 270 in 2011 to 252 in 2013 [13].

In 2014, the decrease in the number of medical and preventive health care facilities of the Ministry of Health of Ukraine was due to military operations in the east of the country, the occupation of some territories, and the lack of information about the activities of health care facilities in these areas. There was also a significant decrease in the labor potential in the field of dentistry, namely: the number of dentists decreased by 12.2% compared to 2013 (from 16,659 in 2013 to 14,625 in 2014) [13].

After the adoption of a package of legislative and regulatory acts in 2017, aimed at the implementation of transformation processes – the Law on the Autonomy of Health Care Institutions (Law of Ukraine "On Amendments to Certain Legislative Acts of Ukraine Regarding the Improvement of Legislation on the Activities of Health Care Institutions" No. 2002-VIII of April 6, 2017) and methodological recommendations to the law (Methodical recommendations on the transformation of health care institutions from budget institutions into communal non-commercial enterprises approved by the Working Group on the Reform of the Financing of the Health Care Sector of Ukraine on February 14, 2018), the transformation of health centers from budget institutions into communal non-commercial enterprises begins. In order to optimize the network, improve its material and technical support, effective use of available material resources, communal non-commercial enterprises are created by combining property subordinated to the

Departments of Health. An example of such a reorganization is the decision of the Kyiv City Council in 2018 to create a communal non-profit enterprise "Kyiv stomatologiya" by merging 14 communal enterprises and institutions (dental polyclinics of Kyiv districts) into a single structure. Thus, dental institutions are being united into powerful centers, administrative workers are being reduced, and the management of institutions and the circulation of funds are being centralized.

Radical changes in the dental care financing system, which began on April 1, 2020, when the Medical Guarantee Program at the level of secondary (specialized) medical care became operational, completely changed the system of financing medical and dental care [12]. Hospitals that provide secondary (specialized) medical care, including dental care, started working under contracts with the National Health Service of Ukraine (NHSU) and received appropriate funding for the provided medical services. Due to the introduction of quarantine restrictions in connection with the pandemic of the acute respiratory viral infection COVID-19, communal health care facilities provided only emergency care, which limited the facilities' ability to mitigate financial risks by receiving funds from self-financing activities.

In 2019-2020, the number of institutions that included dental departments will significantly decrease, the number of independent dental polyclinics will decrease, and the number of children's dental polyclinics will almost halve. Dental offices in rural areas and in educational institutions experienced a special decrease.

According to the "Dental medical care in outpatient conditions" package, dental institutions provide dental services free of charge, financed by the National Health Service under concluded contracts. The scope of state-funded services includes primary examination, emergency dental care for children and adults, and planned dental care for children (except for orthodontic procedures and prosthetics).

Other dental services can be paid by the patient independently or at the expense of separate targeted programs from the local budget. In the Program of Medical Guarantees for 2021, dental care for adults and children is allocated to a separate outpatient package, the cost of which is 116 hryvnias. Medical institutions have the opportunity to officially introduce paid services, transparently form the price and compete for customers as full-fledged commercial structures.

Dental care for Ukrainians was provided in health centers of the Ministry of Health of Ukraine,

institutions of departments and ministries, private offices and polyclinics. According to the data of the State Statistics Service of Ukraine and the results of the state and industry statistical reports of the institutions of the Ministry of Health of Ukraine, which were submitted to the state institution "Center of Medical Statistics of the Ministry of Health of Ukraine", an analysis of the main indicators of the structural component of dental care was carried since 1990 [2].

The absolute number of medical and preventive institutions of the Ministry of Health of Ukraine that provided dental care decreased by 73.4% (95% CI 72-75%) over a 30-year period (1990-2020): if in 1990 – dental care was provided by 5,093 health care institutions of the Ministry of Health of Ukraine, then in 2020 – 1,355 health care institutions of the Ministry of Health of Ukraine. The reduction affected the number of independent dental polyclinics – by 31.7% (95% CI 21-42%), from 246 to 168 institutions, and to a greater extent dental departments and offices of medical and preventive institutions – by 76.6% (95% CI 75-78%), from 3906 to 1187 units.

Statistics of private dental care has been kept only since 2008. According to the data of the State Statistics Service of Ukraine and the "Center of Medical Statistics of the Ministry of Health of Ukraine" for the period 2010-2020, there is a clear trend towards an increase in the number of private institutions or units providing dental care (access points): if in 2010, the number of private dental offices was 3695, then in 2019-2020 - 4214 and 4467, respectively, which is by 14.0% (95% CI 11-17%) and 20.9% (95% CI 18 -24%), respectively more than the initial level of 2010. The number of private polyclinics/centers did not show clear trends to change and fluctuated between 617-704 institutions in different years. In this way, there is a certain substitution of dental care provided in health care facilities of the Ministry of Health of Ukraine by private dental care, which is confirmed by the presence of an inverse correlation between the number of access points to dental care in communal and private healthcare facilities (Spearman's correlation coefficient  $r=-0.65$ ;  $p=0.045$ ).

A more objective picture emerges when comparing relative indicators. It can be seen from Figure 1 that during the observation period, after a long plateau (1990-2010), in 2015, the availability of communal dental facilities almost halved (from 1.0 per 10,000 population in 1990 and 1.1 in 2010 . to 0.5 in 2015;  $p<0.001$ ), and in 2019-2020, compared to the beginning of observation, it more than tripled (to 0.3-0.3 per 10,000 population;  $p<0.001$ ). It

should be noted that a significant decrease in the provision of dental facilities was registered in 2019-2020, even compared to 2015 (0.3 and 0.5 per 10,000 population, respectively;  $p<0.001$ ). Since the official registration of private dental facilities by the Center of Medical Statistics of the Ministry of Health of Ukraine has existed only since 2008, we evaluated the dynamics of the supply of facilities of this form of ownership and the general supply of dental facilities for the period 2010-2020. During this period of time, the supply with private facilities shows a steady tendency to increase – 0.8 per 10,000 population in 2010-2015 and 1.0-1.1 in 2019-2020, respectively ( $p<0.001$ ).

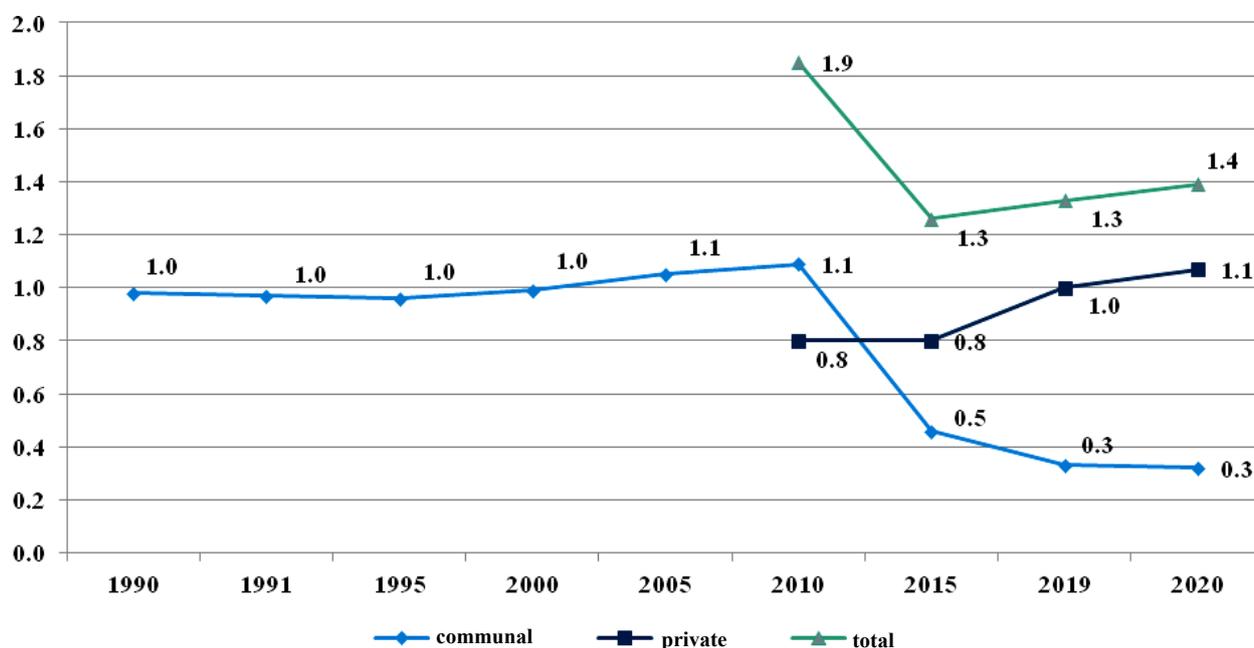
Even with such multi-vector dynamics of provision with dental institutions of various forms of ownership, the total provision with these institutions decreased in 2015-2020 compared to 2010 by almost 30% (from 1.9 to 1.3-1.4 per 10,000 population;  $p<0.001$ ).

The revealed negative dynamics of the provision of communal and general provision of dental institutions may negatively affect the availability of dental care in the future. Under such conditions, there is a need for regulatory bodies to slow down the liquidation of public sector dental institutions and stimulate the development of the private sector ones.

According to the Center for Medical Statistics of Ukraine, the total number of dentists in 1995 who provided dental care in state, in departmental and private health care institutions was 22,793 [2]. The opening of new dental faculties in the system of the Ministry of Health of Ukraine, as well as private institutions of higher education, an increase in the licensed volume of specialist training led to an increase in the number of specialists of the dental profile. The highest indicator of the total number of doctors-dentists in 2010 was 29,308. Reforming the health care system and low wages contributed to the outflow of highly qualified workers to the countries of the European Union. Such changes are associated with a significant reduction in dental personnel in communal healthcare facilities of the Ministry of Health of Ukraine. The largest number of doctors-dentists, who were involved in providing dental care in health care facilities of the Ministry of Health of Ukraine was registered in 2010 – 21,313 specialists. With the implementation of the transformation of the health care system in 2017, the number of doctors-dentists working in communal health care institutions probably decreased: in 2020 it will be 8,901 people, which is by 58.2% less compared to 2010 and by 39.7% compared to 2015 ( $p<0.001$ ). At the same time, a clear tendency to increase the personnel

potential of doctors-dentists involved in private healthcare facilities is observed. As of January 1, 2021, 8,940 dentists worked in privately owned health

care facilities, including: 6,934 dentists, 346 children's dentists; 521 dentists-surgeons; 1097 dentists-orthopedics; 388 dentists and orthodontists.



Note: calculated by data of SI "Center of Medical Statistics MPH Ukraine".

**Fig. 1. Dynamics of provision with dental facilities of various forms of ownership (per 10,000 of population, 1990-2020)**

The provision with dentists working in communal institutions per 10,000 population was characterized by a polynomial functional dependence of the 3rd degree (value of approximation reliability  $R^2=0.9466$ ) and varied from the lowest indicator in 1990 of 3.7 per 10,000 population, with a gradual increase to 4.6 in 2010 (the average annual growth rate for the period 1990-2010 – 101.1%) and a further decrease to 3.0 in 2020 (the average annual rate of decline in the period 2020 -2020 - 95.8%). The supply of dentists working in private institutions had a linear tendency to increase (the reliability value of approximation  $R^2=0.9577$ ) – from 0.5 per 10,000 population in 1995 to 2.3 in 2020; the average annual growth rate was 106.3%. The trend of the general supply of dentists is also determined by the polynomial functional dependence of the 3rd degree (the value of the approximation reliability  $R^2=0.9434$ ) and looks like this: growth from 1995 to 2010-2015 from 4.0 to 10,000 to 6.4-6.3 in 2010-2015 (the average annual growth rate was 103.2-102.3%, respectively) with a further decline to 5.4 in 2020 (the average annual decline rate for the period 2015-2020 – 96.9%), which is more than the original

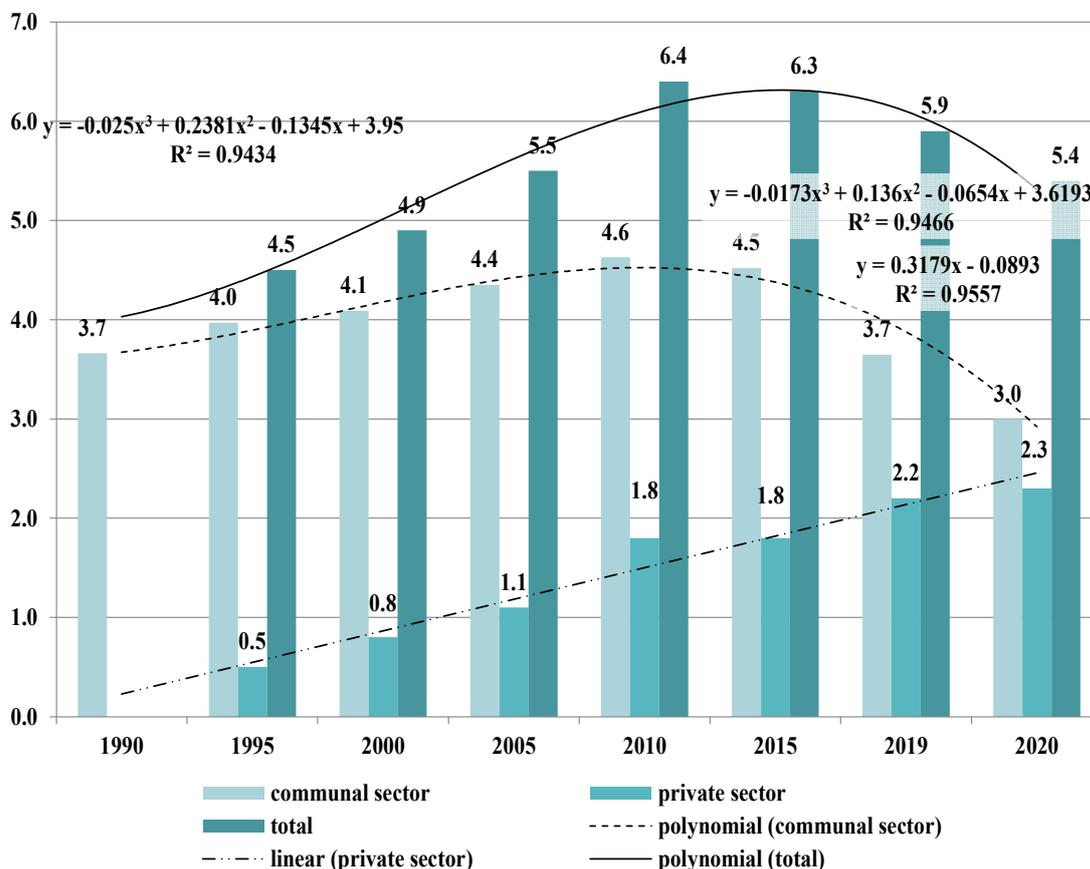
rate in 1990 (3.7 per 10,000 population), but less compared to the countries of the European Union – 8.8 (2019) (Fig. 2) [14, 15, 16].

The ratio of working dentists in the public health care sector to doctors working in the private sector is changing towards a significant increase in the number of personnel in the private sector: in 2010, for the provision of dental care in the public sector, 72% of dentists, in 2020 – only 59.7% of specialists (reliability of differences according to the  $\chi^2$  criterion is 1403.951;  $p<0.001$ ).

It should be noted that the introduction of new technologies in dentistry has changed the norms of time spent on dental interventions [7]. If in 1991 the duration of time for visiting one patient was 20 minutes, and during one working shift (the duration of the working week is 33 hours or 6 hours 36 minutes with a 5-day schedule), the doctor had to accept up to 18 patients (of them primary – 4, secondary – 14), then in 2020 one visit was from 1 hour or more [4]. An increase in the labor intensity of a dentist reduces the number of visits per doctor position, which in 2017 amounted to 2,433.6 visits in public healthcare institutions and 816.2 visits in

private institutions [13]. At the same time, there is an alarming trend towards a decrease in the number of visits to a dentist per resident of Ukraine, which in 2008 was 1.1 (95% CI 0.9-0.1.3), in 2017 it

decreased to 0.8 (95% CI 0.78-0.82) compared to 2008 p=0.003), and in 2020 – to 0.4 (95% CI 0.38-0.42) compared to 2017 p=0.001) visits per year.



Notes: R2 – indicator of approximation; y – equation of trend line which is a formula describing trend line and its adequacy to data points.

Fig. 2. Dynamics of provision with dictor-dentists with differentiation according to communal and private sector (1990-2020 pp. per 10,000 population)

A reduction in the personnel potential of the industry with an increase in the labor intensity of a dentist reduces the indicators of the availability of dental care, which is confirmed by the decrease in the number of visits per resident of Ukraine [13].

In 1990, the training of highly qualified personnel to provide dental care was carried out at 7 dental faculties of higher education institutions (HEIs), and in 2020 – at 21 HEIs of the Ministry of Health, the Ministry of Education of Ukraine and privately owned. During the last decade, the state order for the training of dentists has been significantly reduced, which contributed to the increase of the average rating score of the external

examinations for enrollment in the budget form of study under the "Dentistry" educational program, which is the highest among all medical specialties and score was 186.2 in 2020 The decrease in the training of dentists on a contract basis is due to the increase in requirements for admission to medical higher education institutions. The increase in the number of unused license places for the training of dentists prompted HEIs to refocus on the training of foreign citizens.

Internship training in 2020 was carried out at 21 higher education institutions that train interns in the specialty "Stomatology", among them: 16 – Higher education institutions of the Ministry of Health of

Ukraine (3 of which are postgraduate education institutions), 2 – Higher education institutions of the Ministry of Education of Ukraine, 1 – Higher education institutions of the Ministry of Defense of Ukraine and 2 private higher education institutions. In 2020, the scientific-pedagogical and scientific potential of the Higher Education Institutions of the Ministry of Health of Ukraine (13 stomatological faculties and 3 institutions of postgraduate training) had 1,411 teachers. The reform of the system of higher education in health care, the decrease in the number of students in higher education institutions caused a tendency to decrease the number of teaching staff.

### CONCLUSIONS

1. Ukraine has a powerful infrastructure and personnel potential that provides dental care at a high scientific and technical level: the private sector of providing dental care is developing actively, the number of dental offices is increasing, and a network system of dental clinics is being formed. The implementation of the transformation of the health care system in 2015-2020 prompted communal medical and preventive institutions to reorganize and become autonomous with further optimization, which led to a decrease in their number.

2. The total number of dentists providing dental care in Ukraine has been gradually decreasing since 2010 and reached a minimum level in 2020, which is associated with the beginning of the transformation of the secondary health care sector, the reduction of

the state sector of dentistry, quarantine work restrictions in all dental institutions.

3. A reduction in the number of access points and the staffing potential of the dental service leads to a decrease in the availability of dental care in Ukraine, which is evidenced by a sharp decrease in the number of visits to the dentist per 1 resident per year.

4. The policy in the field of higher dental education aimed at increasing the requirements for entrants, the practical transition to the training of dentists on a contract basis with a large share of foreign students does not allow training a sufficient number of dentists for the field and to compensate for the migration processes of labor dental potential to European countries.

### Contributors:

Mazur I.P. – methodology, formal analysis and data verification, project administration;

Lekhan V.M. – conceptualization, editing of the final version of the study;

Rybachuk A.V. – conducting research, data collection, preparation of the primary version of research, visualization.

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