

THE CONTRIBUTION OF UNIVERSITIES TO THE HEALTH SYSTEMS DEVELOPMENT

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INTRODUCTION

Research, development and innovation are three directions that go hand in hand, being crucial for the improvement of any system [1]. These directions are even more important in the health systems. Development aims to improve operation and performance using the existing resources, while innovation involves adopting different, previously unused approaches, from new types of resources to changes in perspective and strategy [1].

There is a continuous need for innovation and development in health systems around the world as the systems should be up to date with the technological and informational advances that move at a relentlessly fast pace, on the one hand, and also should keep up with the permanent refreshment of resources and improvement of processes they carry out to achieve their objectives, on the other hand.

Health systems, according to the World Health Organization (WHO) 2000 definition, are represented by "Resources, actors and institutions related to the financing, regulation and provision of health actions, where health actions are any set of activities whose primary intention is to improve or maintain health" [2,3]. At the same time, it is necessary to take into account the complexity of the interactions that health systems may have with other sectors, since these, although not directly aimed at influencing the health status of the population, can do so by influencing the socio-economic-cultural and environmental determinants of health.

The methodology for assessing the performance of health systems developed by the European Observatory for Health Systems and Policies [3] presents the sub-functions of each of the four functions of the health systems: governance, resource generation, financing and service delivery, as well as the connexions between them. However, assessing the performance of a health system cannot be done without analysing the contribution of each actor within the system to the fulfilment of these functions [3].

Universities, with a defining role in the development of the three directions mentioned at the beginning, and with an essential role in training, are among the actors with an important contribution to the development and operation of health systems.

Intuitively and continuously, universities generate human resources for the health system. First of all, we mention the

Research, development, and innovation are vital, interconnected pillars essential for the continuous improvement of health systems. As health systems must keep pace with rapid technological advancements and evolving societal needs, universities play a crucial role in supporting and shaping these systems through education, research, and innovation. This study explores the contribution of universities to the four key functions of health systems—governance, resource generation, financing, and service delivery—based on a targeted literature review and key policy documents, including the WHO World Health Report 2000 and frameworks from the European Observatory on Health Systems and Policies. Universities, particularly those focused on medicine and pharmacy, generate human resources for healthcare, but other institutions—ranging from technical to economic and social sciences—also support health system development in complementary ways. Despite high graduation rates, challenges such as workforce retention and geographic disparities in healthcare provision highlight the need for closer collaboration between universities and policymakers. Universities also contribute to policy development, public health promotion, and preventive strategies through interdisciplinary research and internal initiatives that foster healthy behaviours. By aligning with the values of the Magna Charta Universitatum—such as academic freedom, equity, and social responsibility—universities become key actors not only in academic excellence but in driving sustainable transformation of health systems for the benefit of local and global communities.

Key words Resources, workforce, infrastructure, health system

prepare future doctors, dentists, pharmacists, licensed assistants and any other health personnel directly involved in patient care. Anyhow, there are many other universities that generate human resources involved in health system administration, development and innovation of health infrastructure and medical equipment, ensuring a healthy environment that support human health, etc: economic universities, polytechnic universities, faculties of computer science, architecture or mechanics, universities of veterinary medicine are just a few.

MATERIALS AND METHODS

The research was based on a targeted literature review. The starting point were the main sources describing the health system functions and subfunctions and the health system performance assessment frameworks, respectively the WHO World Health Report 2000 and the Health system performance assessment: a framework for policy analysis of the European Observatory for Health Systems and Policies [3]. The approach was to identify how, through its activities, universities address each of the 4 major functions of the health system: governance, financing, resource generation and service delivery.

Governance means policy and vision, information and intelligence combined with effective oversight, developing the necessary legislation and regulations, while also taking into account the voice of all actors in the system [2,3]. Resources in the health system are human resources, infrastructure, medical equipment, consumables, medicines and medical devices [2]. By resource generation, the WHO refers to the availability, distribution of all specified resources and the continuous training of human resources [3].



The financing function ensures sufficient, stable income, the pooling of all income from different sources and their equitable distribution, efficient, effective management and allocation of capital according to needs [3].

The provision of services includes the full range of activities, from the organization and operation of medical institutions, to the provision of services to the population, whether they are public health services, primary care, specialized care, or rehabilitation services [3].

The main roles of the universities in the functioning and development of health systems was identified through a non-systematic review of the specialized literature. The first document analysed was the Magna Charta Universitatum 2020, signed by 975 universities from 94 countries [4], through which they commit to respecting certain values in fulfilling their roles and missions. Among these, we note: the commitment to equity, diversity, inclusion and respect [5]. Universities promote education as a fundamental and accessible right for all, throughout life. They contribute to global scientific progress, but remain deeply involved in local communities. At the same time, they become spaces of dialogue and tolerance, supporting human development, sustainability, health and prosperity on a global scale [5,6].

Focusing on the functions and subfunctions of the health system and the roles that universities assume (or should assume), the analysis of the specialized literature aimed to identify examples of how they are contributing to the education and continuous training of human resources, to the scientific progress and to bringing innovations to the medical system, how they influence health policy making, how they contribute to the health services provision, supporting the health and prosperity of local and large-scale communities.

RESULTS

1. Training and development of human resources

According to the WHO recommendations, higher education institutions are called upon to adapt their internal structure and teaching methods to meet modern educational requirements, with a clear focus on transformation and social relevance [7]. This involves the integration of educational practices focused on interprofessional collaboration, social responsibility and preparing students for the complex realities of the health system [8]. At the same time, these institutions must be aligned with national accreditation systems and professional standards, so that the training offered is recognized, valid and adapted to the needs of society [7,8]. The contribution of universities in the preparation of licensed human resources is undeniable. Universities carry out training programs mainly for future doctors, dentists, pharmacists, licensed medical assistants, midwives, radiological assistants, biochemists, coders, etc. Some professions have been introduced recently, others are established. As the health system changes and evolves, new professions may be introduced. Curricula are also constantly updated to the realities on the ground. "These aspects should be aligned with country accreditation systems, standards and needs, and promote social accountability, inter-professional education and collaborative practice. Reflecting the growth in private education esta-

blishments, it is critical that quality standards are aligned across public and private training institutes." [8]

It should be noted that not only UMPs participate in this process, but in collaboration with them, or individually, other types of universities are in charge with training of personnel who contribute to the development of health systems. The most obvious and classic examples in this regard are bachelor's and master's programs that train professionals in economics, law and administration. Other examples in this sense and which respond to the new holistic approach to community health are universities with training programs in geography that train specialists in health geography who perform geographical analysis of health services [9]; architecture faculties train specialists in hospital architecture; technical faculties train specialists in medical bioengineering, etc. The continuous updating of curricula to meet the ever-changing needs of health systems and technological advances [10] is also attributed to universities. For example, with the development of Diagnostic Related Groups (DRG) in some countries such as Australia [11] and Poland [12] new programs for training medical coders have been established. Similarly, study programs for dietetic nutritionists have been introduced in Romania [13]. To meet the need for continuous adaptation of the curriculum, some of the UMPs in Romania introduced palliative medicine as a mandatory subject starting with 2021 [14]. Numerous UMPs in Europe have introduced a subject called "problem-based learning" (PBL) as a mandatory subject, which has been proved to be a good method of teaching, learning and improving problem-solving skills. Many studies reported improved social and communication skills for these students, compared to those who learned through other methods [15].

Universities, in accordance with current trends and the values they promote, have the duty to ensure the best possible multidisciplinary training for future specialists, to help them understand complex problems, to work in multidisciplinary teams, to have innovative thinking and find quick solutions, contributing to increasing the resilience of health systems [16–18].

Continuous training and development of medical and non-medical personnel for the benefit of the development of health systems can be ensured by universities through the provision of continuing medical education programs. A current trend is the development of soft skills for professionals (e.g. leadership skills, strategic thinking, interpersonal communication, etc.), sometimes together with hard skills (e.g. clinical expertise, ability to interpret medical data, etc) in short-term programs [7,19]. However, in the European region the Bologna system is still preferred, through which higher education is divided into bachelor's, master's and doctorate programs.

2. Contribution to the generation of other types of resources through research and innovation

Universities contribute, by communicating research results, to bringing improvements in the organization and financing of health systems, to the adoption of new models of service provision, to the implementation of actions to increase the performance of health systems.

Through fundamental research activity, they develop and test new technologies and interventions that can be used in clinical practice. An example of this is the contributions of the University of Liverpool in the field of medical devices by developing a novel contact lens that monitor intraocular pressure or a contact device for in vivo measurement of corneal biomechanics [20].

Universities can also contribute to the development or improvement of the infrastructure of health systems and can facilitate their integration into society through the technologies they study and produce. For example, the Politecnico University of Milan contributed to the design of a so-called hospital of the future for better integration of the building into the urban landscape [9].

Research results inform health decisions and policies towards more resilient health systems. Academic and research institutions should actively address the gaps in evidence that inform health resource policies. They are encouraged to generate data and explore solutions in key areas, such as regulating dual practice (healthcare workers holding jobs in both public and private practices), increasing quality and efficiency in service delivery, and optimizing the distribution of skills among different categories of health personnel. Relevant research can guide strategic decisions and contribute to strengthening health systems. This is more oriented towards the organization of human resources, but can be extrapolated and is a valid recommendation for all types of resources in the health system [7,8].

Universities contribute not only to the achievement of research but also to the development of research capacity by including research methodology topics in the curricula, in order to instil in students a filter regarding qualitative research with the potential for actual benefit [21,22].

3. Influencing health policies

Universities provide experts for think tanks or so-called "policy incubators" that through their activity influence the development of health policies; some of these groups are affiliated with universities. According to statistics from 2017, the most think tanks are in the USA (1,872), China (512), UK (444), India (293) and Germany (295) [23] all of these countries being in the top 10 largest gross domestic product (GDP) in the world [24]. But, not all of these think tanks are affiliated with universities. However, it is essential to build a young academic pool, capitalize on the role of academics as mentors, organize high-level academic forums and reports, and collaborate with experts from various fields to provide strategic recommendations to decision-makers. The European Parliament has published several articles on think tanks, one of the most recent ones are in the field of public health [25].

Universities organize or participate in forums, conferences, health policy dialogues or other forms of interaction between stakeholders in the health system. Universities play a key role in aligning the training of health professionals with long-term national policies. To effectively respond to the real needs of the population and the health system, human resource planning must be integrated into local, regional or national health, education, employ-

ment, migration and finance strategies. This requires a constant dialogue between ministries, academia, the private sector and civil society, as well as the continuous adaptation of educational policies and investments according to the labour market developments and social priorities [8].

Also, through the research findings they make available to decision-makers, they help them adopt evidence-based laws for the well-being of the population. As it is the following example of a study on the potential impact of increased taxation of sugar-sweetened beverage consumption conducted by Harvard University and several collaborators that may partially overlap with the preventive role of universities [26]. A cohort model was used to simulate the potential impact of a tax of \$0.01/ounce over 10 years. The results showed that the tax would reduce sugar-sweetened beverage consumption by 20% and mean (body mass index) BMI by 0.16 units among youth and 0.08 units among adults in the second year for a cost of \$3.16 per BMI unit reduced [26]. In 2015, Berkeley Municipal Code Chapter 7.72 Sugar-Sweetened Beverage Distribution Tax went into effect [27]. A 2016 new study was conducted to compare the effects of the sugar-sweetened beverage consumption in Berkeley versus other comparable cities. The results showed that in Berkeley the sugar-sweetened beverage consumption decreased by 21%, while in the comparator cities increased by 4% [28]. The tax was later adopted in other cities in the US. Another study conducted by the University of Pennsylvania Perelman School of Medicine, Philadelphia also demonstrated a decrease in the total volume sales of sugar-sweetened beverages by 51% during the 4-week study period, before and after the introduction of a \$1.5/ounce tax in Philadelphia in 2017 [29].

Universities also contribute to developing the capacity to develop and evaluate health policies by including topics related to this field in the curricula.

4. Service Delivery

Universities, especially medical schools, often operate teaching hospitals that serve as centres of excellence in patient care, medical education, and clinical research. These hospitals provide high-quality health services, treating complex cases while training students, junior doctors, and fellows in a real-world clinical setting. A relevant example is the Massachusetts General Hospital in Boston, affiliated with Harvard Medical School, which is internationally recognized for its quality of care, research innovations, and its essential role in training future generations of physicians [30]. Furthermore, the teaching hospitals facilitate the transfer of clinical research findings directly into medical practice, fostering innovation and better patient outcomes.

Universities are also involved in the development of public health programs (prevention, health education, etc.), in collaboration with local authorities and communities. In addition to generating studies that can lead to the development of evidence-based laws for the health of the population, universities carry out their own awareness and education projects for the population they are part of. A good example of this is the online campaign "This is

Public Health”, first launched by the United States Association of Schools and Programs of Public Health (ASPPH) and later carried out by the Association of Schools of Public Health in the European Region (ASPHER). ASPHER cooperated with ASPPH to replicate the campaign in Europe, by opening a challenge. In Italy, the campaign that aimed to increase awareness of the importance of public health among the general population, and among the health workers was conducted by a consortium of the Schools and Programs of Public Health of Vita-Salute “San Raffaele” University, Milan, University of Parma, University of Pavia and Politecnico di Milano that won the bid [31].

DISCUSSIONS

Although universities, especially in Romania that comes after Lithuania on the number of graduates in OECD countries, with 26.2 and 27.3 graduates per 100 000 population in 2021 [32], are passionate about training future healthcare professionals, training alone is not enough to ensure the health system workforce. Methods of retaining staff must also be found. Despite the fact that Romania has a very large number of medical graduates, when it comes to practicing doctors, with 3.5 doctors per 1000 population, falls under the OECD average of 3.7 doctors per 1000 population [32]. This might be explained by the fact that the trained international students return to their countries, but also by high rates of emigration among medical staff because they cannot find a satisfactory job. This clearly shows the need for collaboration between universities and decision-makers so that the system to be able to absorb all the graduates and the universities to train the type and the number of specialists the system needs. The equitable distribution of resources in the territory must also be taken into account. Here too, the universities can contribute to covering “desertified” areas with health personnel [33].

In the spirit of the values enshrined in the Magna Charta Universitatum – institutional autonomy, academic freedom, commitment to equity, diversity, inclusion and respect – universities assume a complex and essential role in supporting public health. They are not only spaces for professional training, but true supporters of sustainable development in the field of health. In parallel, universities are centres of advanced research that generate essential scientific evidence for the development of efficient and equitable public policies. This approach reflects not only an academic mission, but also an ethical responsibility towards the community.

The research itself must be based on evidence that substantiates the need, novelty and relevance of the research [34].

Research must be carried out in multidisciplinary teams and must respond to the needs of the health system. The role of universities is to demonstrate the usefulness of research through the benefits brought to the system (reducing costs, increasing quality, etc.) in order to attract funds for research. In the absence of a clear and convincing substantiation, most funds are directed towards the provision of services that are a priority for the health system [35].

Involvement in the development of health policies must also consider how research results are transmitted so that

they are easy to understand and facilitate their use in policy development. The main recommendation is that the message for decision-makers should be presented and structured as for a non-academic, with colloquial words, but with an equally powerful message. The decision-maker, or any other stakeholder, should be driven to go through all the stages of translating research finding into policy: awareness, interest, desire and action. For the best results, research and policy might be co-produced and feed directly into one another [36].

The provision of services is a function of the health system associated with individual offices, clinics or hospitals. As mentioned above, there are many university hospitals at which training, research and treatment are combined. But in addition to the classical involvement in the treatment of disease, UMPs, but also of other profiles, can be involved in primary prevention or even primordial prevention. Education for primary prevention could start by example, as universities, through their internal policies and regulations for campus management, can promote healthy habits among students: regulations to discourage smoking or excessive alcohol consumption among students, making sports facilities available to them at preferential prices or free of charge to prevent a sedentary lifestyle, promoting reduced sugar consumption by making foods with low or zero sugar content available in student canteens, etc. Regarding primary prevention, in addition to promoting vaccination campaigns, which are mainly carried out by UMPs, other universities can contribute to primary prevention by researching and developing equipment or technologies that reduce the effects of already existing risk factors. One such example is the invention of electrophoretic micro-encapsulated electrophoretic display done by undergraduates from the Massachusetts Institute of Technology (MIT). MIT was the first institution to fill in a patent for an electrophoretic display in 1996 [37]. Later it was proved via in vitro studies that this type of display is safer to be used for longer exposures; the same levels of reactive oxidative species (ROS) are reached at the retina in the liquid crystal displays (LCD) faster than in the electrophoretic displays [38]. Another example would be the attempt to genetically modify some houseplants to be able to purify the air in the room by capturing particles dangerous to human health [39]. This study was conducted by researchers at the University of Washington.

CONCLUSIONS

Universities play an essential role in supporting public health and the development of health systems, with responsibilities that go beyond the educational sphere. In addition to training future professionals, they actively contribute to research, public policy development and health promotion. Universities can support the retention and equitable distribution of the workforce, including in underserved areas. At the same time, they can support primordial prevention through internal policies that promote healthy lifestyles among students, and through technological research they can contribute to primary prevention. University research must be well-founded, carried out in multidisciplinary teams and translated into a language accessible to decision-makers in order to have an impact. →

UMPs – but also those with a technical, social or humanistic profile – can contribute in a complementary way to solving health challenges, through interdisciplinary approaches. Thus, in accordance with the vision of Magna Charta and the commitments that the signatory universities have made, they become not only centres of academic excellence, but also pillars of the transformation of health systems for the benefit of society.

Authors' contributions

DN, SGS conceived conceptualization, methodology and designed the manuscript. DN, SGS realized the literature search. DN, SGS analysed and interpreted the findings. DN and SGS reviewed all the sections of this article and had an input in the writing of each section of the manuscript. DN, as a corresponding author, formatted the final version and submitted it.

All authors have read and approved the final version of the manuscript.

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Conflict of interest

None declared

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