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Geriatric medicine: achievements and prospects

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The article is a lecture on the history of development and the current state of geriatric medicine. The purpose of the lecture is to consider the stages of the formation of geriatrics as a scientific and clinical discipline and to substantiate its significance. The lecture defines concepts such as holistic approach, complex geriatric assessment, geriatric syndrome. The role of the founders of international and domestic geriatrics, such as M. Warren, B. Isaac, D. Sheldon, I.I. Mechnikov, V.N. Anisimov, E.S. Pushkova, is described. Various directions of geriatric medicine are considered and the necessity of their study is justified. The results of scientific research in geriatrics are analyzed. The basic principles of the ortho-geriatric approach, which becomes crucial for the successful treatment of elderly patients with fractures, as well as the features of geriatric rehabilitation, geriatric cardiology, are described. In conclusion, the author offers several models for the development of geriatric medicine.

Keywords: geriatric medicine; geriatric syndrome; complex geriatric assessment; perioperative assessment of an elderly person; orthogeriatrics; models of geriatric medicine development.

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Гериатрическая медицина: достижения и перспективы

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Статья представляет собой лекцию об истории развития и современном состоянии гериатрической медицины. Цель лекции — рассмотреть этапы становления гериатрии как научной и клинической дисциплины и обосновать ее значимость. В лекции даны определения таким понятиям, как холистический подход, комплексная гериатрическая оценка, гериатрический синдром. Описана роль основателей международной и отечественной гериатрии, в том числе М. Уоррена, Б. Айзекса, Д. Шелдона, И.И. Мечникова, В.Н. Анисимова, Э.С. Пушкова. Рассмотрены различные направления гериатрической медицины и проанализированы результаты научных исследований. Описаны основные принципы ортогериатрического подхода, который становится определяющим для успешного лечения пожилых пациентов с переломами, а также особенности гериатрической реабилитации и гериатрической кардиологии. В заключение автор предлагает несколько моделей развития гериатрической медицины.

Ключевые слова: гериатрическая медицина; гериатрический синдром; комплексная гериатрическая оценка; периоперационная оценка пожилого пациента; ортогериатрия; модели развития гериатрической медицины.

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ЭКО•ВЕКТОР

The aim of the lecture is to review the stages of formation of geriatrics as a scientific and clinical discipline and substantiate its importance. The lecture is intended for general practitioners, medical students, and all specialists involved in treatment of older patients.

The history of geriatric medicine dates back not many years. However, many outstanding doctors and researchers participated in its formation. Ignatz Leo Nascher, an Austrian American physician, is the first to be mentioned. He called for the creation of a separate discipline focused on the problems of older people, similar to pediatrics for the examination of children [1]. Nascher drew attention to the peculiarities of prescribing drugs to older patients, for example, antidepressants. In 1909, he first used the word "geriatrician" derived from two Greek words "iatros" (healer) and "*geros*" (old person).

In 1943, the *British Medical Journal* published an article by Marjory Warren, a physician who we still call the "mother" of geriatrics [2]. The article was the result of clinical cases by Warren at a hospital in South London, which was overcrowded with older patients who were not receiving effective treatment. Warren was the first to suggest introducing into clinical practice a special approach to inpatient care for older people, since, in her opinion, they had specific needs that were different from those of younger patients. She divided older patients into five groups:

- Patients with chronic diseases, but relatively mobile, who can take care of themselves and ask for help only when climbing stairs.
- Patients with chronic diseases and urinary incontinence.
- Bed-bound patients with chronic diseases and urinary incontinence.
- Patients with dementia or confused mental state who need restrained beds for their own safety, but not violent or annoying to other patients.
- Patients with dementia who should be isolated from other patients.

The model of treatment for older patients, proposed by Warren, was based on the following:

- Care of legs
- Dental care
- Vision correction
- Nutrition adjustment
- Normalization of sleep
- Prevention of a decrease of independence in daily life.

Then, Warren proposed introducing the specialty of geriatrics and creating a multidisciplinary team of nurses, therapists, physiotherapists, social workers, and doctors of other specialties trained to work with older patients, as well as equipping clinic spaces considering the special needs of such patients. As a pioneer in the rehabilitation of older people, Warren advised her colleagues and showed particular interest in training nurses. Many of her ideas remain leading in modern geriatric practice.

We call Warren the "mother" of geriatrics, and Joseph Sheldon is rightfully called its "father." As a consultant to the hospital, he dealt with the problems of outpatient geriatrics and emphasized the importance of maintaining self-care skills and treatment of incontinence, hearing impairment, and foot diseases. With an interest in mobility issues, he established that 11% of older patients were bedridden and recommended physical therapy at home as a standard of treatment. He also advocated the prevention of falls and suggested the need for good lighting and installation of handrails; these important principles are not outdated nowadays [3].

The history of Russian geriatrics started with Ilya Ilyich Mechnikov, who was the first to call the science of aging gerontology. Many Russian scientists were interested in life extension, namely, A.A. Bogomolets, V.V. Frolkis, D.F. Chebotarev, Z.G. Frenkel, V.N. Dilman, and I.I. Likhnitskaya, who worked at different times in the twentieth century, but together created the foundation of the doctrine of life extension, aging problems, and principles of longevity. In our time, a famous scientist in this field is V.N. Anisimov, MD, PhD in Medicine, Professor, Corresponding Member of the Russian Academy of Sciences, and Honored Scientist of the Russian Federation. His numerous works recognized by the world community focused on the problems of the prevention and etiology of aging and issues of carcinogenesis [4–6]. The Gerontological Society, founded by the leading scientists of the country, has actively studied the problems of aging. In 1981, a large all-union sectoral program of the scientific research "Life Extension" was launched, and the Scientific Council of the Academy of Medical Sciences of the USSR on the problem of "Gerontology and Geriatrics" was created. In 1986, the department of geriatrics was opened at the Leningrad State Institute for Advanced Training of Physicians, the predecessor of the North-Western State Medical University named after I.I. Mecnikov.

Ella Solomonovna Pushkova can rightfully be considered the founder of geriatrics in St. Petersburg. She contributed to the opening of the City Geriatric Medical and Social Center in 1994 and created a geriatric service that opened geriatric departments and offices in different parts of the city and trained geriatricians, nurses, and social workers. For the first time in the country, she introduced a comprehensive geriatric assessment, including an outpatient service that functions in Primorsky, Kolpinsky, and Admiralteisky districts. The Health Committee supported the initiative to implement integrated assessment by approving it by special order in 2007.

In 2015, the Ministry of Health of Russia appointed Olga Nikolaevna Tkacheva, Doctor of Science, Professor, to the position of Chief Geriatric Specialist. In 2016, Order No. 38n of the Ministry of Health of the Russian Federation was

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issued, approving the Procedure for the provision of medical care in geriatrics. From this moment, we started a new stage in the development of Russian geriatrics.

Holistic approach. What is the foundation of geriatric medicine? Geriatric medicine is based on a holistic approach. In ancient Greece, Heraclitus formulated the concept of "holism" from the word *holon* (wholeness, integrity). He said, "All is out of one, one is out of all." In contemporary medicine, the concept of "holistic approach" implies the treatment of not only a disease but the human body as a whole.

An experienced healthcare professional is aware that it can be difficult to assess the condition of an older patient, understand the main cause of the deterioration of his health, establish contact with him, prescribe effective treatment, and monitor his actions. Why does this happen? We call the traditional approach in medicine as a disease-oriented approach. This means that we examine and treat the patient in accordance with his complaints, seeking to improve his condition.

Older patients have dysfunctions in various organs and systems. However, the manifestations of these disorders are not always presented as easily recognizable signs of the disease. Systems and organs may not actually be the source of symptoms and problems, even if they appear that. Traditional curricula in medical schools and colleges are still focused on performing physical examinations, and its details must be recorded in medical records. However, these data do not contain information about whether the patient has any functional impairment. For example, they do not show whether the patient can move and change clothes without assistance, whether he has preserved the functions of the pelvic organs, etc.

Clinical guidelines, which are the basis for making medical decisions, may not always be useful when working with older people. Clinical trials rarely include patients aged >65 years. Recommendations are given in relation to the management of one disease; however, polypathology and polymorbidity are typical for older patients.

How can older people in need of a complex of medical services be identified? Who needs help first and at what extent? How should the health care resources be allocated properly? Who can identify better the most vulnerable older patient population? An evaluation of all the problems of an older person, including social, domestic, mental, and emotional aspects, represents a holistic approach. On physical examination, even carefully performed, the deficit of many functions is not visible, which prevents the diagnostics and prescription of adequate treatment.

There are generally accepted geriatric measures for assessing the functional status of older patients, which should become an essential aspect of assessing the patient's condition. Therefore, geriatricians should follow a holistic approach. This approach is based on a comprehensive geriatric assessment, as well as on the concept of "geriatric syndrome" introduced in 1909.

In the middle of the twentieth century, British physician Bernard Isaacs identified four syndromes, which he called "geriatric giants," namely *immobility* (limitation of mobility), *instability* (difficulty maintaining balance), *incontinence*, and *intellectual impairment* (cognitive impairment). Initially, geriatric syndrome was defined as "conditions that develop periodically in older people that can be triggered by a stroke and are often associated with subsequent functional decline" [7].

Geriatric syndromes include the following:

- Frailty
- Dementia
- Delirium
- Depression
- Syndrome of behavioral and mental disorders in patients with dementia
- Osteoporosis
- Sarcopenia
- Functional disorders
- Reduced mobility
- Imbalance
- Dizziness
- Orthostatic syndrome (orthostatic hypotension, orthostatic tachycardia with or without symptoms)
- Visual impairment
- Impaired hearing
- Urinary/fecal incontinence
- Constipation syndrome
- Malnutrition
- Dehydration
- Chronic pain syndrome

All geriatric syndromes are interrelated, as the emergence and development of one syndrome can exacerbate the risk of the other. The study revealed that in older patients, the risk of falls is increased through the presence of cognitive impairment, urinary incontinence, and malnutrition (low intake of vegetables, fruits, and protein). Over 2.5 years, the "Crystal" study showed that the emergence of new complaints of urinary incontinence increased the risk of falls by two times, since the elimination of such complaints was associated with an improvement in cognitive functions and a 55% reduction in the risk of falls [8].

Comprehensive geriatric assessment enables identification of the priority problems of the patient among many pathologies and disorders and to develop an individual schedule of measures to improve the functional status of the patient based on a multidisciplinary approach.

For the first time in Russia, the "Crystal" study (2009–2018) assessed the problems of older patients who

survived cardiovascular diseases. Scientific and practical interest coincided in it:

- Obtain an objective and complete presentation of the health status of older people living in St. Petersburg (clinical, functional, psychological, and social status)
- Identify a group of older people who require increased attention from geriatric services
- Develop recommendations to improve the quality of life of older people, based on the principles of evidence-based medicine

The results of the "Crystal" study confirmed the value of a comprehensive geriatric assessment and provided unique information on the prevalence and relationship of geriatric syndromes and chronic diseases, as well as the functional status of the older people in St. Petersburg and conditions leading to lethal outcomes [9]. Based on obtained data, three PhD thesis were defended; recommendation for medical teachers and clinical guidelines were developed, which are now used by both geriatricians and general practitioners [10–13].

Perioperative management of older patients. Many older patients require surgical treatment. Unfortunately, it is not uncommon for us to experience medical ageism, i.e., when older people are denied the necessary surgery due to the high risk of adverse consequences. Despite the development of surgical technologies and the improvement of surgical and anesthetic techniques, mortality after surgical treatment in older patients remains high, as well as the amount of complications and unsatisfactory functional results, reaching 30% [14]. Moreover, a proper perioperative assessment of the patient's condition avoids much of these problems.

Fracture of the proximal femur is the major cause of injury-related mortality in older patients [14]. Mortality in this condition in older patients is five times higher in men and three times higher in women compared with mortality in the general population and remains the same for 10 years after surgery [15]. To increase the survival rate and improve the functional results of surgical treatment, the factors that increase the risk of lethal outcomes should be identified. Various reviews demonstrate 35 patient-specific factors and nine so-called systemic factors. However, the mechanisms activating these factors are not fully understood [16]. The literature provides an unambiguous opinion that mortality is associated with age, gender, comorbidities, functional state, dementia, arrhythmias, and congestive heart failure. Systemic factors include delayed hospitalization, delayed surgical treatment, inadequate surgical planning, inappropriate anesthesia, prolonged hospitalization after surgery, and insufficiently trained nursing staff. There are controversial opinions regarding the influence of factors such as delirium and fracture type on postoperative mortality. Biological mechanisms that influence mortality include comorbidities, cardiovascular function, immunity, bone remodeling, glycemic control, and calcium homeostasis. Patient-related factors include dehydration, anemia, hypotension, heart rate variability, risk of pressure ulcers, malnutrition, and use of catheter [17]. Is it possible to change something before the surgery? The age, fracture type, and comorbidities certainly cannot be changed. However, the condition of an older patient can be evaluated from the perspective of a geriatrician, namely, the patient's functional status can be determined using questionnaires and a short test of physical functioning. However, it is not always possible to conduct these surveys, especially if the patients are not available because of a serious condition.

In a systematic analysis of 12 studies, frailty was associated with increased in-hospital mortality [odds ratio (OR) 2.77; 95% confidence interval (CI) 1.62–4.73], increased 1-year mortality (OR 1.99; 95% CI 1.49–2.66), and increased hospital stay (1.05; 95 % CI 0.02–2.07) [18]. Thus, frailty was found to be associated with worse outcomes in terms of mortality and loss of independence in patients undergoing surgery. In 2012, the American Surgical Association emphasized the need to check the presence of frailty before surgery in the recommendations "Optimal preoperative assessment of geriatric patients" [19].

How does the assessment of the presence of frailty affect mortality? Certainly, it does not affect by itself. However, a decrease in mortality is noted in the treatment of patients with frailty according to an individual plan of perioperative preparation. Thus, when using the results of frailty screening initiative before surgery, the 30-day overall mortality decreased from 1.6% to 0.7% ($p < 0.001$) and from 12.2% to 3.8% in frail patients ($p < 0.001$), the 180-day mortality decreased from 23.9% to 7.7% ($p < 0.001$), and 1-year mortality decreased from 34.5% to 11.7% ($p < 0.001$). This study was performed in 9153 patients aged 60.3 ± 13.5 years admitted in the general surgery department using a risk analysis index of 14 points in 2 min. If the patient scored at least 21 points, the head of department, surgeons, anesthesiologists, and other specialists also consulted the patient before the start of the surgery [20]. The efficiency of diagnosing frailty in preoperative preparation was confirmed in another study [21] where 275 patients aged ⩾65 years, with the history of surgery, were followed up for 1 year after inpatient treatment. In patients with ⩾5 frailty criteria, the postoperative risk of mortality increased nine times (relative risk 9.01; 95% CI 2.15–37.78; $p = 0.003$), and the duration of hospital stay after surgery was an average of 9 (5–15) versus 6 (3–9) ($p < 0.001$) days.

Screening for delirium is an important aspect of preoperative preparation [22]. Postoperative delirium is a nonspecific cerebral syndrome characterized by simultaneous disorders of consciousness and attention, perception, thinking, memory, psychomotor behavior, emotions, and

sleep–wake schedule. The severity of delirium varies from mild to very severe, and in older patients, it occurs in up to 50%; therefore, all potential risk factors for its occurrence should be identified and recorded in the medical history. A preoperative screening assessment of the risk of cardiovascular complications should also be performed using the revised Lee Index recommended by the European Society of Anesthesiology. To identify the risk of postoperative respiratory failure, which often provokes pneumonia in older patients, special scales should be used.

Thus, the examination by the geriatrician and correct perioperative assessment can help reduce postoperative mortality and complications. Patients with frailty, cognitive impairment, and reduced functional status should receive special attention of a multidisciplinary team. Necessary techniques in the management of patients before surgery include screening and prevention of potential complications, as well as individual preoperative preparation programs based on a comprehensive geriatric assessment of patients, including those aged >80 years, regardless of the hospitalization specialty. During the preoperative preparation, the need to optimize the nutritional status of geriatric patients in outpatient and inpatient care is noteworthy [22].

Cancer treatment and geriatric medicine. Some older patients with cancer do not receive standard surgical treatment because of contraindications associated with an inaccurate assessment of surgical risk. Oncologists are beginning to use a comprehensive geriatric assessment to adapt treatment to the oncogeriatric population [23]. A special tool, the PACE questionnaire, was used in an international prospective study of 460 older people with cancer. The PACE survey conducted before the elective surgery included parameters such as instrumental and basic activities of daily living (ADL), functional status, and presence of frailty. Mortality, postoperative complications (morbidity), and duration of hospital stay were recorded within 30 days postoperatively. The investigation revealed that low instrumental ADL (IADL), frailty, and abnormal functional status increase the relative risk of postoperative complications by 50% and extend the hospital stay. Thus, the use of geriatric approaches in oncology can expand the indications for surgery and reduce the probability of postoperative complications.

Orthogeriatrics as a new branch of geriatric medicine. Two orthopedic surgeons, namely, Lionel Cosin and Michael Devas, should specially be mentioned. Cosin was the founder of the geriatric day hospital and the pioneer of orthogeriatrics and related rehabilitation. He was the first to successfully perform surgery on patients with a femoral neck fracture and conduct their early rehabilitation with assistance of a physiotherapist. As a general surgeon, he had a talent for rehabilitation. In 1940, in Orsett, Essex, England, he operated on war victims and was responsible for 300 beds for patients with chronic conditions. In Oxford, in 1957, he built a geriatric day hospital, where the operated patients underwent a comprehensive assessment of the condition, medical treatment, and rehabilitation. The geriatric day hospitals aimed at medical and nursing care, rehabilitation, social and recreational activities, and assistance to caregivers [23].

In 1957, Devas was appointed Consultant for Orthopedics in Hastings (England). He worked with Bobby Irvine, a consultant geriatrician, to examine patients with surgical needs and patients with trauma. It was the first orthogeriatric team in history. Devas recommended urgent surgery to even the weakest older patients and encouraged their early rehabilitation. This approach assured patients the return of independence. He said: "The first step in rehabilitation is the first step" [23].

Contemporary orthogeriatrics is based on three basic principles:

- Prevention of the first fall and osteoporosis as the main risk factor for fracture.
- A team-based approach in the treatment of a fracture, namely, early surgical treatment of an older patient, followed by active rehabilitation in a trauma hospital.
- Prevention of repeated falls and rehabilitation in specialized centers or sanatoriums for older patients.

Briefly, patient hospitalization should be performed no later than 4 h after admission, the surgery should be performed no later than 48 h after admission, all patients should receive consultation of a geriatrician or therapist, reduction of the risk of pressure ulcers, examination for osteoporosis, and prevention of falls.

The Russian healthcare system is urgently introducing a systemic "orthogeriatric" approach for the treatment of osteoporotic fractures to restore function and prevent recurrent fractures. Thus, the Fragile Age Alliance was created, which is the national branch of the *Fragility Fractures Network* (Global Organization against Fractures). The alliance includes the Russian Association of Gerontologists and Geriatricians, the Russian Association on Osteoporosis, the Trauma Osteosynthesis Association of Russia, the Russian Society of Rehabilitation Therapists, and the patient society OSTEORUS. The strategic aims of the alliance include training Russian doctors and nurses in the principles of the orthogeriatric approach, development of guidelines, protocols and other documents based on cutting-edge scientific data to facilitate the introduction of a multidisciplinary approach to the management of older patients with fractures, and establishment of links with other Russian and international communities of professionals and patients, and informing the general public, including relatives of older patients with fractures, about the possibilities of orthogeriatric care and conducting scientific research.

Development of psychogeriatrics. An important branch of geriatric medicine is psychogeriatrics, which emerged in the early 1950s, when psychoemotional disorders characteristic

of older people were identified. Psychogeriatric assessment units were initially located in psychiatric hospitals. Support services were introduced later, including day hospitals, nursing homes, and residential care facilities [23]. To differentiate between physical and mental illness in older patients, psychiatrists and geriatricians have joined their forces. Day hospitals have appeared for older people with mental disorders who do not need constant supervision. Many countries now have day departments for patients with cognitive impairments. Although there are not so many of them in Russia, a special program of measures has been developed for early diagnostics, treatment, and prevention of cognitive impairment in older people. Much of the work in this area was performed with assistance of social services.

Rehabilitation of patients following stroke. As already mentioned, geriatric treatment measures are focused on rehabilitation, particularly in patients who had a stroke. Stroke is common in older people. Recovering from stroke is difficult, not only through the efforts of the patient but also of his family, medical workers, and social services. Bernard Isaacs created the first post-stroke rehabilitation units. Such rehabilitation is currently performed in most vascular centers, but the participation of a geriatrician is not an accepted methodology yet.

The following techniques have become the prospects for geriatric rehabilitation of patients who had a stroke:

- Robotic training of walking in older and senile patients with movement disorders.
- Functional and clinical three-dimensional video analysis of movements and gait rehabilitation with extended biofeedback in a virtual reality environment in patients with frailty and gait disorders of various origins.
- Individual programs of physical rehabilitation for patients with frailty, based on the results of the stress cardiorespiratory testing.
- Treatment and rehabilitation of geriatric patients with chronic pain and kinesiophobia, using virtual reality.
- Treatment of neurological disorders in patients with geriatric syndromes using transcranial electrical stimulation with a weak current.
- Neuromuscular diagnostics and rehabilitation of patients with imbalance and balance disorders due to geriatric syndromes.
- Robotic training for the restoration of fine motor skills in geriatric patients with neurodegenerative diseases.

The correctly mastered methods of preventing pressure ulcers, cognitive impairments, dysphagia, and decreased mobility in post-stroke cases are equally important.

Geriatric cardiology. What can geriatric medicine offer cardiologists if the majority of cardiac diseases occur in older patients and treatment methods have become generally accepted? This is not entirely true or not true at all. The Russian Association of Gerontologists and Geriatricians, together with the Russian Gerontology Research and Clinical Center, have developed several documents on the aspects of management of older patients with cardiac diseases, including the following:

1) "Aspects of diagnostics and treatment of chronic heart failure in older and senile patients. The opinion of experts of the Society of Heart Failure Specialists, the Russian Association of Gerontologists and Geriatricians, and the Eurasian Association of Therapists" [24].
2) "Treatment of arterial hypertension in older and senile patients with frailty syndrome. Expert opinion and clinical guidelines" [25].
3) "Antithrombotic therapy in old and senile age: the general consensus of experts" [26].
4) Methodological guidelines "Pharmacotherapy in older and senile patients" [27].
5) "Lipid-lowering therapy for the primary prevention in patients aged ⩾75 years. Consensus of the experts of the Russian Association of Gerontologists and Geriatricians, the National Society for the Study of Atherosclerosis, the Russian Society of Cardiology, and the Association of Clinical Pharmacology" [28].

For the further development of geriatric cardiology, it is required to introduce contemporary techniques as soon as possible, namely,

- Cryoablation or radiofrequency ablation of the orifice of the pulmonary veins in patients with frailty and atrial fibrillation with preserved and reduced left ventricular ejection fraction.
- Stenting of ischemia-dependent coronary artery in patients with frailty and angina pectoris, based on the results of an effort test with visualization of myocardial ischemia zones or on the results of assessing the functional reserve of coronary blood flow to reduce polypragmasy and improve the quality of life.
- Diagnostics and treatment of coronary microvascular dysfunction in older and senile patients.
- Individual programs of physical rehabilitation for older and senile patients with heart failure, based on the results of cardiorespiratory stress testing.
- Remote multi-day monitoring using telemetric registration and electrocardiographic analysis in older and senile patients (for outpatient and inpatient use).

Models for geriatric medicine development. The main model for the development of geriatric medicine is interdisciplinary work and comprehensive geriatric assessment. Consultants should work in various specialized clinics and departments of surgery, ophthalmology, traumatology, and neurology. A model used abroad will probably be promising, namely, the opening of clinics specializing in syndromes such as fall clinics, memory clinics, stroke clinics, and parkinsonism clinics. One of the most effective models of geriatric practice is the hospital for war veterans. The expanded tasks

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of the hospital include opening of regional geriatric centers for coordinating the organizational, methodological, educational, instructive, and scientific work of state organizations that are part of the unified system of providing medical care to older patients, as well as for medical and diagnostic activities.

In a short period of development of geriatrics worldwide, new scientific and clinical areas have emerged and been improved, aimed at returning older people to an active life. Geriatric medicine takes a holistic approach based on a comprehensive geriatric assessment to treating older patients. Rehabilitation is of key importance in the treatment of older people; nowadays, it requires the widespread introduction of modern methods. Geriatrics should contribute to the elimination of ageism in medicine, so that all patients, regardless of age, receive effective care.

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