

Arthritis and Its Impact: Challenges and Opportunities for Treatment, Public Health, and Public Policy

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Although literally meaning “inflammation in a joint,” the term arthritis is commonly used to describe more than 100 rheumatic diseases and conditions that affect joints, the tissues surrounding joints, and other connective tissue.¹ Conditions such as osteoarthritis, rheumatoid arthritis, fibromyalgia, systemic lupus erythematosus, gout, and bursitis are characterized by musculoskeletal pain and, in some cases, progressive physical impairment of joints and soft tissues.² Arthritis is one of the most prevalent chronic conditions in the United States, and the economic, social, and psychological impact associated with it is enormous.^{3,6} It has been cited as one of the most pressing public health problems in the US.³ Some of the effects of arthritis are easily translated into economic terms (eg, lost wages, medical care costs), but many other effects are not easily quantified (eg, pain, reductions in housekeeping activities, inability to enjoy leisure activities).

Although its impact is primarily on quality of life rather than mortality, arthritis significantly affects not only the individuals who have the disease but their families and society as well. Fortunately, over the past several decades there have been dramatic advances in the understanding of risk factors for arthritis and in its treatment. It is important for clinicians and other health care providers, public health officials, and policymakers to understand the burden of arthritis and recent advances in the field so that they can respond to the challenges of arthritis in terms of services and interventions to

minimize its impact. In this issue brief, we will review the prevalence and impact of arthritis in terms of pain, activity and role limitations, work disability, and economic, social, and psychological consequences. We will discuss public health strategies and examine what can be done to target arthritis in terms of primary, secondary, and tertiary prevention. Finally, we conclude with some policy implications for North Carolina.

Prevalence

Arthritis affects an estimated 46 million Americans,⁴ approximately 1 in 5 US adults. This number is expected to increase to an estimated 67 million individuals by the year 2030.⁷ Approximately 21 million people have osteoarthritis,

“It will take dedicated financial investment from the public, nonprofit, and private sectors to minimize and prevent arthritis-related disabilities from affecting the state’s workforce as well as keeping people living with arthritis active and living independently.”

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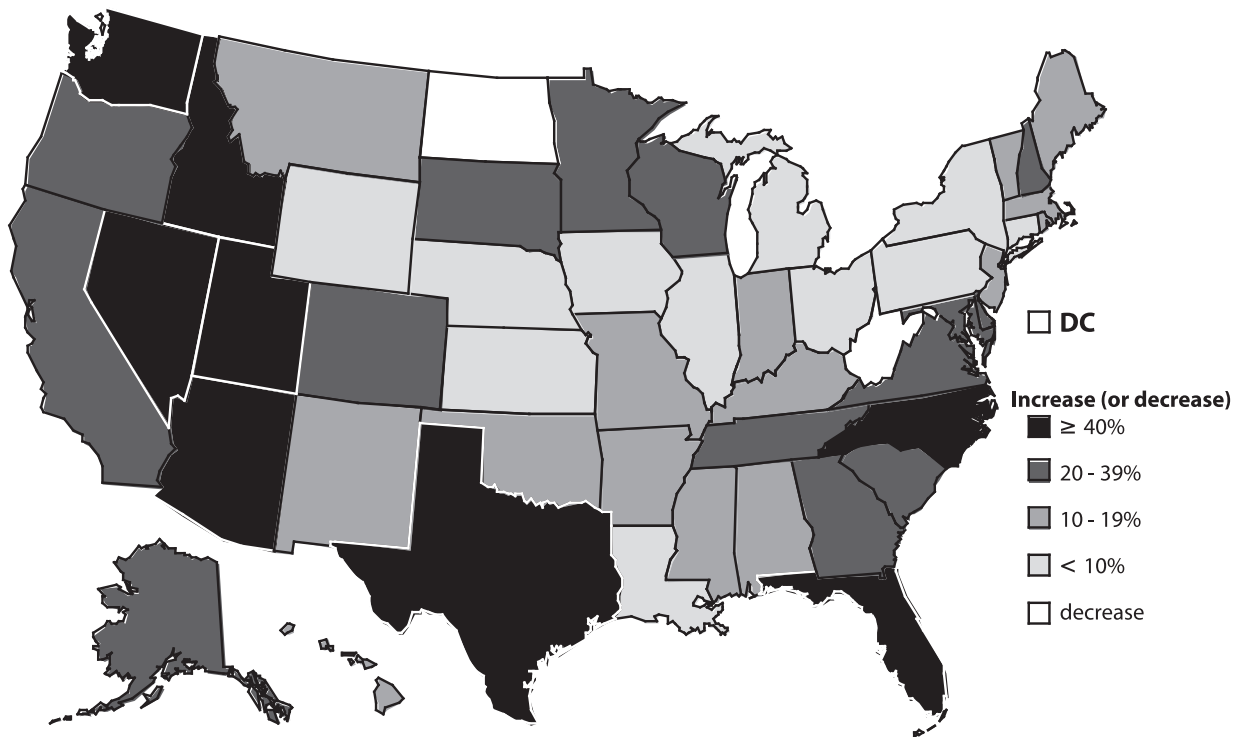
3.7 million have fibromyalgia, and another 2.1 million have rheumatoid arthritis.² North Carolina has a higher rate of arthritis than the US national average and is one of the states with the highest projected increase in arthritis prevalence by the year 2030.⁸ (See Figure 1.) For this issue of the *North Carolina Medical Journal*, the North Carolina State Center for Health Statistics has provided recent data on the prevalence of self-reported doctor-diagnosed arthritis in North Carolina along with a breakdown by selected demographics and risk factors. (See Running the Numbers.) More than 1.7 million North Carolinians reported having arthritis in 2005, and this number is projected to increase to more than 2.7 million by 2030. Individuals who report arthritis also are more likely to report their health as fair or poor than are individuals without arthritis.

Estimates of the prevalence of knee symptoms and radiographic knee osteoarthritis in African American and Caucasian adults aged 45 years or older were recently reported by our research group at the Thurston Arthritis Research Center at the University of North Carolina at Chapel Hill. Data were collected from the Johnston County Osteoarthritis Project, a population-based study of osteoarthritis in North Carolina.⁹ Knee symptoms were present in 43% of participants. Twenty-eight percent had radiographic knee osteoarthritis, and 16% had symptomatic knee osteoarthritis. African Americans had slightly higher prevalence of knee symptoms and both radiographic knee and

symptomatic knee osteoarthritis, but significantly higher prevalence of severe radiographic knee osteoarthritis compared to Caucasians. The Johnston County Osteoarthritis Project has been a unique resource for the nation as a population-based laboratory for the study of risk factors for, and racial and gender disparities in, osteoarthritis. This long-standing community-based project is discussed in the commentary by Edwin Hartman and colleagues.

Although some risk factors associated with various forms of arthritis are nonmodifiable (eg, female sex, older age, genetic predisposition), identification of modifiable risk factors is critical to improve the lives of individuals with arthritis or to prevent its occurrence or progression.¹⁰⁻¹³ (See Table 1.) Modifiable risk factors include obesity, joint injuries, infections, and certain occupations (eg, shipyard work, farming, heavy industry, any occupation with repetitive knee bending). Several commentaries in this issue discuss arthritis risk factors. Stephen Marshall and Yvonne Golightly discuss the link between sports injuries and osteoarthritis and note the biological basis for such a relationship. Stephen Messier and colleagues describe dietary and physical activity interventions. Individuals with lower levels of formal education and lower income have long been known to be at higher risk for arthritis and poor outcomes. Our commentary on the relationship between arthritis and the environment discusses sociodemographic issues and introduces a novel approach to evaluating potential factors behind these observations.

Figure 1.
Percent Increase From 2005-2006 in the Projected Number of Adults With Self-Reported Doctor-Diagnosed Arthritis, by State.



Source: Centers for Disease Control and Prevention. *MMWR Morbidity and Mortality Weekly Report*. May 4, 2007/56(17):423-425.

**Table 1.
Risk Factors for Arthritis**

Nonmodifiable	Female sex
	Older age
	Genetic predisposition
Modifiable	Obesity
	Joint injuries
	Infections
	Certain occupations
	Lower levels of formal education
	Lower income

Impact of Arthritis

Activity and Role Limitations

In addition to its high prevalence, arthritis is the nation's leading cause of disability. Activity limitations due to arthritis were reported by nearly 19 million US adults each year during the period 2003 to 2005.⁷ Individuals who are disabled from arthritis have problems in more areas of daily life than do individuals with disability from other conditions.^{14,15} Arthritis has negative effects on family role functioning as well.¹⁶ Role limitations associated with rheumatic disease include significant reductions in the amount of time individuals spend engaging in activities such as shopping, visiting the bank and supermarket, homemaking, interacting with friends and family, or participating in hobbies.^{6,16,17}

Economic Impact and Work Disability

In comprehensive studies of the economic cost of musculoskeletal disease, Rice and colleagues estimated that the total cost of these conditions is equivalent to 2.5% of the Gross National Product.⁶ Total costs for arthritis rose from \$65 billion in 1992 dollars to \$82.5 billion in 1995 dollars.^{6,18} In 1995, the estimated economic impact of musculoskeletal conditions on the US economy was \$214.9 billion. (See Table 2.) Of this amount, direct costs accounted for 41% and indirect costs accounted for 59%. For all types of arthritis, the total cost was \$82.5 billion or 38% of the cost of all musculoskeletal conditions.¹⁸ (See Table 2.)

**Table 2.
Total, Direct, and Indirect Costs of All Musculoskeletal Conditions and All Forms of Arthritis in Billions of 1995 Dollars.***

Condition	Direct Costs	Indirect Costs	Total Costs
All musculoskeletal conditions	88.7 (41%)	126.3 (59%)	215
All forms of arthritis	21.7 (26%)	60.8 (74%)	82.5

* Adapted from Praemer, Furner and Rice, Musculoskeletal Conditions in the United States, American Academy of Orthopaedic Surgeons, 1999.

The estimated direct costs of medical care for all forms of arthritis totaled \$21.7 billion. (See Table 2.) Expenditures for nursing home care were \$12.7 billion and accounted for 59% of direct costs. Hospital inpatient care totaled \$3.1 billion or 14% of direct costs. According to the National Hospital Discharge Survey, patients hospitalized for arthritis account for approximately 2.6 million days of care. Administration and physician outpatient costs were \$1.2 billion and \$1.1 billion, respectively, with each approximately 5% of direct costs.¹⁸

The magnitude of the estimated indirect costs due to arthritis in 1995 dollars was \$60 billion⁸ or 74% of total cost.¹⁸ (See Table 2.) As noted in previous arthritis cost studies, indirect costs are almost 3 times greater than direct costs.⁶ This estimate would be even larger if the costs attributed to loss of homemaking functions could be more easily determined. Also, older women have lower labor force participation rates, resulting in lower estimates of economic impact for the current cohort of women.

As reflected in the indirect costs, the capacity of individuals with arthritis to work is significantly affected.¹⁹⁻²⁴ In fact, arthritis is a leading cause of work loss and work disability payments.^{22,25} In two of the most prevalent rheumatic conditions, osteoarthritis and rheumatoid arthritis, many studies have documented significant work disability.²⁶ Determinants of work disability in individuals with rheumatic disease exist at both the societal and individual levels. Societal level risk factors include economic conditions, attitudinal and architectural barriers, types of jobs available, employer practices, and the characteristics of disability pension plans.²⁵ Individual level determinants include work autonomy, social factors, and disease factors.^{21,25}

The costs of arthritis extend far beyond the direct medical care costs and the indirect costs associated with work loss. The intangible costs include pain, psychological distress, changes in family structure, limitations in instrumental and nurturing activities, and changes in appearance resulting from deformity.^{6,26}

Pain and Psychological Consequences

As noted in the commentary by John Winfield, pain is a major determinant of physician visits for patients with arthritis. It is a significant predictor of patient and physician assessment of general health status as well as an indicator of future level of disability. Pain also has been found to be more important than physical or psychological disability in explaining medication use among patients with rheumatoid arthritis.^{27,28} Pain presents challenges to health care providers, and some important suggestions for addressing this problem in arthritis are noted in Winfield's commentary on pain and arthritis.

In addition to the significant economic costs, activity and role limitations, and pain and disability associated with arthritis, the psychological impact of arthritis has been documented in a number of clinical studies.⁶ The impact of arthritis on psychological status has been measured in terms of

depression, anxiety, learned helplessness, coping strategies, cognitive changes, and self-efficacy. Higher levels of psychological distress have been noted in individuals with arthritis than in members of the general population in most studies. The levels of distress reported in arthritis patients were comparable to levels noted in clinical samples of individuals with other chronic conditions.²⁹ Higher levels of psychological distress in individuals with arthritis have also been associated with poorer status on clinical outcome variables as well as with increased health services utilization.³⁰

Research efforts in depressive symptoms and disorders have focused on osteoarthritis, rheumatoid arthritis, fibromyalgia, and systemic lupus erythematosus.²⁹ Although depressive symptoms and disorders are more common among clinical samples of individuals with arthritis than in samples of the general population, the majority of individuals with arthritis do not report increased depression. Among persons with rheumatoid arthritis, the loss of valued activities and the self-perception of the ability to do activities are strongly correlated with psychological status.¹⁷ Robert DeVellis and Brenda DeVellis discuss the links between depression and arthritis in their commentary.

Public Health Strategies

Although there is presently no cure for arthritis, there are interventions targeting primary, secondary, and tertiary prevention. (See Table 3.) The aim of primary prevention is to reduce the incidence of symptomatic disease (impairment). In order for primary prevention to be successful or even feasible, the risk factors for the disease must be known. While the risk factors for some types of arthritis and many rheumatic conditions are not known, data from cross-sectional and longitudinal studies reveal that obesity and occupational and sports-related injuries are risk factors for osteoarthritis.^{13,31,32} The Framingham Osteoarthritis Study demonstrated that weight change significantly affected the risk for development of osteoarthritis of the knee in women; a weight reduction of 5.1 kilograms (11.2 lb) over a 10-year period reduced the risk of symptomatic knee

osteoarthritis by over 50%.³² Greg Griggs and Marie Shelton highlight the role North Carolina's *Eat Smart, Move More...NC* program can have in reducing obesity in our state and possibly attenuating some of the arthritis epidemic.

The physical demands of an occupation as a risk factor for osteoarthritis of the knee has been observed in several studies.^{13,31,33} Data from Framingham and the first National Health and Nutrition Examination Survey indicate that jobs that require knee bending and which have at least medium physical demands are associated with increased rates of radiographic and clinical osteoarthritis of the knee.^{13,33} Risk factor modification such as weight reduction and avoidance of occupational and other injuries may prevent the development of osteoarthritis of the knee. Another known target for primary prevention is exposure to ticks that carry the spirochete *Borrelia burgdorferi*, a known risk factor for Lyme disease. Lyme disease is an infectious arthritis which may have chronic manifestations. Avoiding tick-infested areas, checking oneself and one's pets for ticks, and using antitick pesticides are primary preventive measures for Lyme disease.

Secondary prevention is aimed toward early detection and treatment of a disease so that its course may be controlled or favorably altered. (See Table 3.) Secondary prevention is targeted toward reducing disability and generally involves screening for disease. Currently the most appropriate screening test for arthritis is a complete history and physical examination.³⁴ Arthritis may have a wide variety of clinical presentations which may or may not involve the musculoskeletal system. A complete history and physical examination allow the clinician to develop a differential diagnosis, order the appropriate laboratory studies, and formulate a diagnosis and treatment plan. Since early, aggressive therapy may be associated with improved outcomes in arthritis, it is imperative that the clinician consider these diagnoses when evaluating individuals with musculoskeletal or ill-defined systemic complaints. In order for secondary prevention to be successful in improving the outcomes of persons with arthritis, it will be necessary to increase efforts to educate health

Table 3.
Examples of Prevention Strategies for Persons With Arthritis

	Primary Prevention	Secondary Prevention	Tertiary Prevention
Goal	Reduce incidence of disease	Detect disease at early, treatable stage	Reduce disease complications
Target Population	Susceptible	Asymptomatic	Symptomatic
Examples	<ul style="list-style-type: none"> ■ Weight reduction ■ Avoiding sports & occupational associated injuries ■ Avoiding tick exposure ■ Checking self and pets for ticks (Lyme) 	<ul style="list-style-type: none"> ■ History and physical ■ Improved education of health professionals ■ Public education to encourage early diagnosis and treatment ■ HLA/genetic testing (potential) 	<ul style="list-style-type: none"> ■ Improved education of health professionals ■ Medication ■ Physical therapy ■ Exercise ■ Occupational therapy ■ Assistive devices ■ Education ■ Use of effective coping strategies ■ Joint replacement surgery

professionals about arthritis. It is also imperative to increase public awareness about the value of early treatment and diagnosis of arthritis, and it is imperative to have sufficient health care professionals to treat people with arthritis. The manpower shortage in rheumatology is reviewed by Gregory Schimizzi, and Kate Queen gives her perspective on the role of nurse practitioners and physician extenders in meeting the manpower shortage challenge.

Tertiary prevention is aimed at reducing the complications and handicaps resulting from the impairment or disease in symptomatic persons. (See Table 3.) Most research efforts in arthritis have focused on tertiary prevention. Treatment of individuals with arthritis is often a multidisciplinary effort that includes medications to reduce pain and inflammation; complementary and alternative medicines; physical exercise and occupational therapy to maintain functional status and prevent disability; and education to develop coping and health management skills. Recent therapeutic advances in the treatment of rheumatoid arthritis, including the biologic therapies, are discussed by Beth Jonas. Esi Morgan DeWitt examines medication safety in children with arthritis, Jayalakshmi Rao reviews the use of complementary and alternative medicine in arthritis treatment, and Victor Goldberg discusses joint replacement therapy later in this issue of the *Journal*.

Despite its importance in reducing disability, exercise is a frequently neglected part of the treatment plan. Arthritis is now being incorporated into public health messages regarding the benefits of exercise. In contrast to the traditional belief that those with arthritis should avoid vigorous physical activity, recent studies have demonstrated that people with arthritis can benefit from appropriate aerobic exercise without exacerbating their disease.^{35,36} Compared to their peers without arthritis, people with arthritis are often deconditioned and this may worsen their disability. Prolonged inactivity can produce muscle weakness, decreased flexibility, poor endurance, osteoporosis, cardiovascular deficit, fatigue, depression, low pain threshold, and other problems which historically have been accepted as either the natural progression of arthritis or the consequences of therapy.³⁷

In a trial of supervised fitness walking, people with osteoarthritis of the knee who were randomized to the walking group had significant improvement in walking distance and functional status and a decrease in pain and medication usage compared to the control group.³⁶ Similarly, in a trial of people with rheumatoid arthritis and osteoarthritis of weight-bearing joints, those randomized to aerobic exercises had a significant improvement over controls in aerobic capacity, 50-foot walking time, depression, anxiety, and physical activity.³⁷ In a 5-year follow-up study of a conditioning program for people with rheumatoid arthritis, study participants who reported more than 5 hours of exercise per week showed less radiographic progression of joint damage, less hospitalization, and less work disability than those who exercised less than that amount.³⁸ The Arthritis, Diet, and Activity Promotion Trial found that the combination of modest weight loss plus moderate exercise provides better overall improvements in self-reported measures

of function and pain and in performance of mobility in older overweight and obese adults with knee osteoarthritis compared with either intervention alone.³⁹

Studies of community-based exercise programs sponsored by the Arthritis Foundation (eg, Aquatics Program) have shown significant positive changes in participants' pain levels and their ability to perform activities of daily living. This indicates the benefits of regular aerobic exercise in persons with arthritis may extend beyond improved physical functioning. These benefits are discussed in-depth in the commentary by Stephen Messier.

Patient education programs such as the Arthritis Self-Help Course are another adjunct in the treatment of people with arthritis. A meta-analysis of 15 controlled evaluations of psychoeducational interventions for people with rheumatoid arthritis or osteoarthritis showed beneficial improvements in pain, depression, and disability.⁴⁰ There is an emphasis on educational processes which increase self-efficacy and empower the participants to make appropriate health decisions. In a 4-year follow-up study, participants in the Arthritis Self-Management Course retained improvements in pain level and self-efficacy and had a 43% decrease in physician visits compared to nonparticipants.⁴¹ Based on a reach of just 1% of the population with rheumatoid arthritis and osteoarthritis, the projected cost savings to society that would result from a broader implementation of the program would be \$33 000 000. Effective self-management programs with similar content and self-efficacy enhancing processes are also available for people with systemic lupus erythematosus and fibromyalgia.

Conclusions and Policy Implications

In 1998 a consortium of national organizations produced "The National Arthritis Action Plan: A Public Health Strategy," which is a comprehensive and ambitious plan for addressing the looming epidemic of arthritis.⁴² This inspiring plan was developed under the leadership of the Centers for Disease Control and Prevention, the Arthritis Foundation, and the Association of State and Territorial Health Officials. These 3 organizations were joined by nearly 90 other organizations including academic institutions, professional societies, governmental agencies, voluntary health agencies, and others with an interest in arthritis prevention.

The National Arthritis Action Plan is based on the principles that the disability and chronic pain associated with arthritis reduce quality of life and that arthritis can be prevented. The plan is based on a growing recognition that public health must shift its emphasis to include diseases that destroy quality of life and not just those that kill.

The National Arthritis Action Plan outlines a public health strategy with emphasis in 3 areas: (1) surveillance, epidemiology, and prevention research; (2) communication and education; and (3) programs, policies, and systems. Activities in the surveillance and epidemiology area address the need to establish a solid scientific base of knowledge about the prevention of arthritis. The communication and education activities are designed to raise awareness of arthritis as a public health problem and to

stimulate creative responses to this problem. The emphasis in the area of program, policies, and systems is on developing approaches for systematic change based on recognition that arthritis affects individuals in a social context and that this context can be changed in ways that promote health and prevent disease.

The National Arthritis Action Plan followed 2 historic national efforts to address arthritis. The first was the National Arthritis Act of 1975 which led to the development of Multipurpose Arthritis and Musculoskeletal Disease Centers. The second was the establishment of a separate arthritis institute at the National Institutes of Health in 1986, the National Institute of Arthritis, Musculoskeletal, and Skin Diseases. The National Arthritis Action Plan, a third milestone, provided a framework for new partnerships and collaborations to address the important issues and challenges of arthritis. These partnerships helped ensure that Healthy People 2010, the nation's blueprint for improving population health, contained a chapter on Arthritis, Osteoporosis, and Chronic Back Conditions.⁴³ This chapter has specific objectives related to pain reduction, activity limitations, and racial disparities in the rate of knee replacements. The North Carolina Arthritis Program, discussed in the commentary by Denise Brewster and Mary Altpeter, uses these Healthy People 2010 objectives to guide much of its work.

In addition to the incorporation of arthritis-specific objectives in Healthy People 2010, the launch of the Decade of Bone and Joint Disease in the year 2000 has further enhanced society's understanding of the burden of arthritis.⁴⁴ The Bone and Joint Decade is a global, multidisciplinary initiative targeting the care of people with musculoskeletal conditions and bone and joint disorders. Its focus is on improving quality of life as well as advancing the understanding and treatment of those conditions through research, prevention, and education. Worldwide more

than 750 organizations have endorsed the Bone and Joint Decade initiative. More than 50 countries, including the US, have established multidisciplinary National Action Networks to plan activities in their respective countries. All 50 states have endorsed the Bone and Joint Decade, and over 85 health care organizations have pledged their support to the US Bone and Joint Decade Network. This network supports the current efforts of the Arthritis Foundation to pass the Arthritis Prevention, Control, and Cure Act of 2007 (S.626, H.R. 1283).⁴⁵ This Act proposes to strengthen arthritis public health initiatives, which would ensure that more people are diagnosed early and avoid pain and permanent disability. It also proposes to ensure that limited federal funding for arthritis research is used in the most strategic manner possible through the formation of a federal interagency coordinating committee. Additionally, it authorizes a remedy to help address the shortage of pediatric rheumatologists as well as a prevalence study of arthritis in children and a patient registry. Neither North Carolina senator was a cosponsor of the Senate bill in the fall of 2007, but Representatives Butterfield, Etheridge, Price, and Hughes are all cosponsors of HR 1283.

Given its high prevalence and significant economic, functional, social, and psychological consequences, arthritis should receive considerable attention from a societal perspective. The burdens of arthritis will increase dramatically in the near future due to the aging of the population, and this underscores the need for a public health approach. As highlighted in this issue of the *North Carolina Medical Journal*, what we know about the prevention and treatment of arthritis has advanced considerably over the past few decades. There is much that can be done on an individual and societal level to reduce the burden of arthritis, and our challenge is to deliver that message broadly. **NCMJ**

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