



Musculoskeletal Disorders a Universal Source of Pain and Disability Misunderstood and Mismatched: A Critical Analysis Based on the U.S. Model of Care

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Abstract

Musculoskeletal disorders are the leading source of pain and disability globally but are especially prevalent in the industrialized nations including the U.S. In addition to the substantial individual suffering caused the rising monetary costs of these disorders are noteworthy. In the U.S. alone the annual costs have been estimated to be \$874 billion 5.7% of the annual U.S. G.D.P. Despite these expenditures the care provided to patients with musculoskeletal disorders is highly variable and has regularly been shown to have suboptimal outcomes. The many reasons for this ineffective care include the mutable nature of the prevailing syndromes and their limited and variable understanding. The care rendered by a broad and incongruent group of providers who practice disparate methodologies and employ variable treatments. Disorderedly triage comprised of arbitrary selection of providers, care methodologies, and treatments, which is prone to a range of extraneous influences. Treatments that are unable to apprehend the causative pathological processes, which are therefore progressive, cause irreversible damage to the respective musculoskeletal structures, and result in enduring pain and disability. The overall lack of preventative care and the consequent prevalence of these disorders especially in specific work environments and with certain high-risk life styles. This article makes recommendations for better understanding, prevention, early recognition, timely employment of disease altering therapies, streamlining the existing care, and policy initiatives for waste confinement and improvement. These discernments may improve the overall quality of care provided to these patients, diminish the staggering pain and disability caused, and can reduce the immense costs incurred.

Keywords: Pain Medicine, Musculoskeletal Disorders, Spinal Pain, Triage, Management

1. Context

The back and neck disorders, arthritic conditions, and soft tissue syndromes involving the tendons, ligaments, muscles, and cartilages make-up the bulk of musculoskeletal disorders (MSKDs). These conditions are a dominant source of pain and disability globally, but are especially prevalent in the industrialized nations including the U.S. (1). In addition to the substantial individual suffering, the monetary costs of these disorders, to the individuals and the society as a whole, are astounding (2). In the U.S. alone the rising yearly costs of MSKDs have been estimated to be \$874 billion 5.7% of the annual U.S. G.D.P. (3). Despite these mounting costs the care provided to patients with MSKDs in the U.S. has regularly been shown to have suboptimal outcomes (4-6). In addition, the costs incurred exhibit marked regional variability signifying distinct sub-

jectivity in the use of the available resources (5). This article highlights the prevalence, costs and disability from MSKDs in the U.S., explores the many reasons for and consequences of this ineffective care, and proposes strategies for improvement.

2. Prevalence, Disability and Costs of MSKDs

2.1. Prevalence

MSKDs are common worldwide but are prevalent in the industrialized nations including the U.S. (Table 1) (1, 3). The National Health Interview (NHI) Survey conducted by the U.S. census bureau in 2012 reported over half (126.6 million, 54%) of the adults suffering from MSKDs a far greater frequency than circulatory (31%) or chronic respiratory conditions (28%) (1). Low back, neck and chronic joint pains were the most prevalent MSKDs with low back pain reported by

66 million and chronic joint pains by 63.1 million adult Americans (1). The prevalence of MSKDs increased with age and chronic joint pains were reported by 40% of the Americans over the age of 65 years (1). Similarly, from 2010 to 2011, of the 1.3 billion medical diagnoses made in the U.S., 223.6 million (18%) pertained to MSKDs (7, 8). The most common diagnoses rendered were “other and unspecified disorders of the back” and “other and unspecified disorders of joints” given in 12.7% and 8.6% persons, respectively (7, 8).

2.2. Disability

Disability from MSKDs is staggering as they reduce both the effective work force and its productivity (Table 1). In the 2012 NHI Survey 34.5 million U.S. adults (13%) reported significant difficulty performing activities of daily living, which were caused by a MSKD in 50% of the individuals (1). Overall, the back and neck pain disorders were the most common cause of disability except in individuals over the age of 65 years when joint pains were most prevalent (1). Absence from work due to a medical condition was due to a MSKD in 75% of the individuals (1). Chronic back and neck problems were the most common cause of disability amongst adults in prime working ages 18 to 64 years.¹

2.3. Costs

Costs related to MSKDs can be categorized as direct costs of medical care and indirect costs such as from lost wages, disability payments, and legal expenses (Table 1) (Appendix 1 in Supplementary File). The U.S. Department of Health and Human Services estimated the average annual costs of MSKDs in 2009 and 2010 as \$212.7 billion \$82 billion direct costs and \$130.7 billion indirect costs (2). The higher indirect costs were attributed to the large number of individuals with MSKDs belonging to the active workforce. Though the direct costs are generally overt the indirect costs are difficult to estimate. For instance, the costs of lost wages are speculative, the disability claims can be fraudulent, and the costs of narcotic use and abuse can only be discursively linked to the MSKDs. To illustrate, a large fraction of workers' compensation claims related to musculoskeletal injuries, estimated in billions of dollars each year, have been characterized as fraudulent (9). Similarly, in 2012, an estimated 7.7 billion dollars (17%) of the U.S. automotive accident injury related claims were considered as fraudulent (10). Prescription opioids, routinely prescribed to alleviate pain from inadequately treated MSKDs, have significant potential for abuse (11). In 2013, an estimated 1.9 million Americans abused or were dependent on prescription opioids (12). The 2010 yearly costs of prescription opioids were estimated as \$129.5 billion \$53.4 billion due to nonmedicinal use, \$55.7 billion from abuse and

dependence, and \$20.4 billion were linked to opioid overdoses (13, 14). Notwithstanding the assessment problems some have estimated that the overall recent annual costs of MSKDs in the U.S. are \$874 billion 5.7% of the annual U.S. G.D.P. (3).

3. Current Care of Patients with MSKDs

The many reasons for the deficient care of patients with MSKDs can be categorized as: (1) Mutable conditions and the ambiguous sources of pain and disability; (2) disparate care providers and multiple care methodologies; (3) disorderly care and unsystematic referrals; (4) ancillary factors affecting the care choices; (5) non-standardized and ineffective treatments; and (6) inadequate preventative care.

3.1. Mutable Conditions and the Ambiguous Sources of Pain and Disability

Pain and disability stemming from the musculoskeletal system is infrequently due to specific neoplastic, inflammatory or major traumatic lesions and is commonly attributed to, often vague and poorly defined, nonspecific and degenerative conditions (15). As a result, categorizations of the causative pathological processes of many MSKDs remains uncertain and poorly understood. Moreover, these etiological processes are likely heterogeneous and may even be shared for many currently distinct MSKDs. For example, the cellular and matrix dysfunctions of the intervertebral disc (IVD) (16, 17) variably affect the contiguous spinal structures and result in several concurrently present, and currently distinct, clinical syndromes which contribute variably to the patient's overall symptoms (18). Furthermore, the preponderance of contemporary MSKDs are constellation of clinical findings supported only by a battery of subjective clinical tests and radiological discernments. Few of the broad list of such disorders include spondylosis, non-specific low back pain, discogenic pain, rotator cuff disorders, fibromyalgia, myofascial pain, complex regional pain syndrome, sacroiliac and facet joint syndromes (19-26). Furthermore, the tests employed to validate these syndromes are unable to delineate the precise source of patient's symptoms, the causative pathological processes remain frequently obscure and often only the aftermaths of these processes are elucidated. For instance, spinal MRI, the gold standard test for the diagnosis of most spinal conditions, is incapable of detecting the primary cellular and matrix IVD dysfunctions (16, 17). The frequent MRI findings of disc herniation, disc desiccation, loss of disc height, disc bulging and spinal stenosis represent mere after effects of the primary disc dysfunctions (27). Additionally, these MRI findings are encountered in symptomatic as well as asymptomatic individuals

Table 1. Prevalence, Disability and Costs of Musculoskeletal Disorders in U.S.

MSKD	
Prevalence	
MSKDs are common worldwide but are prevalent in industrialized nations particularly in U.S.	
Source (1)	
MSKDs were reported by 54% of adults in the U.S. 126.6 million individuals over the age of 18 years	
MSKDs reported with much greater frequency than other common health related conditions. Circulatory disorders reported by 31%; chronic respiratory conditions by 28% of the adult Americans	
Low back, neck and chronic joint pains were the most common MSKDs reported; low back pain reported by 66 million (28%) adults, chronic joint pains by 63.1 million (27%) adults	
MSKDs reported with increasing frequency in older individuals, their prevalence highest in ages between 45 and 64 years. Prevalence of chronic joint pain and arthritis increased to 40% in individuals 65 years and older	
Sources (7, 8)	
Of the 1.3 billion medical diagnoses made 223.6 million (18%) pertained to MSKDs	
Of the 4,128 diagnoses/1000 population, 723 (17.5%) concerned MSKDs	
The most common diagnoses linked to MSKDs were "other and unspecified disorders of the back" and "other and unspecified disorders of joints" rendered in 12.7% and 8.6% persons, respectively	
Disability	
Large segment of the U.S. work force utilize social services and depends on disability benefits linked to MSKDs	
Disability from MSKDs is notable because they reduce both the effective work force and its productivity	
Source (1)	
13% (34.5 million) of U.S. adults reported difficulty performing routine ADLs because of a medical condition which was a MSKD in 50% of the individuals	
Back and neck pain disorders were the most common cause of disability	
In individuals over the age of 65 years joint pains and arthritis were the most common cause of disability	
Almost 40% of the respondents reported a bed day (1/2 or more days in bed) and 20% reported a lost work day (absence from work in the previous year due to a medical condition), on both occasions the cause was a MSKD in 75% of the cases, far outnumbering all other medical etiologies for lost productivity	
Amongst adults in prime working ages (18 to 64 years), 3.6 million individuals reported inability to work and an additional 1.7 million reported limitations in the work they can perform due to chronic back or neck pain	
Costs	
Costs of MSKDs include direct costs of medical care, and indirect costs from disability, lost wages, disability payments, legal costs and so forth	
Source (2)	
Average annual costs of MSKDs were \$212.7 billion	
Average annual direct costs of MSKDs were \$82	
Average annual indirect costs of MSKDs were \$130.7 billion	
Higher indirect costs were attributed to the large number of individuals with MSKDs belonging to the active workforce	

rendering them less significant (28, 29). Similarly, selective blocks of the various musculoskeletal structures are frequently advocated to determine the precise source of patient's pain and disability (30). However, not only the results of these blocks are subjective, but they afford no information pertaining to the etiology of patient's symptoms (31). Overall, the current methods of cataloging pain and dysfunction emanating from the musculoskeletal system are vague, prone to variable interpretations, and the various often concurrently present sources of pain and disability

remain regularly obscure despite exhaustive patient evaluations and pertinently employed tests. This methodology also promotes symptomatic approach to treatments and restricts early recognition, prevention, and treatment of the underlying pathological processes. Consequently, the latter often progress relentlessly and cause irreversible damage to the respective musculoskeletal structures with enduring pain and disability (18, 32).

3.2. Disparate Care Providers and Multiple Care Methodologies

In addition to the approximate sources of pain and disability, the care provided to patients with MSKDs is by a broad and heterogeneous group of providers allied to both modern medicine and traditional care. Even though these practitioners pursue dissimilar care methodologies and provide distinct treatments, they assert to treat remarkably similar conditions (Table 2). The broad list of practitioners of modern western medicine treating these conditions include a range of surgeons, physical medicine and rehabilitation (PM&R) physicians, anesthesiologists, neurologists, radiologists, rheumatologists, and physical therapists. The corresponding list of practitioners of traditional and alternative therapies is also exhaustive and include chiropractors, acupuncturists, osteopathic doctors, and massage therapists. Approximately 19,374 orthopedic surgeons, 8,906 PM&R physicians, 4,014 pain medicine specialists (2013), 44,400 chiropractors (2012), and 27,965 acupuncturists (2009) predominantly treated MSKDs in the U.S. (33-35). The curricula and training of the diverse practitioners of modern western medicine is remarkably dissimilar and their scope of practice is often confined to treatment of select spinal, individual joints or soft tissues conditions (36). Similarly, the perspectives of practitioners of traditional medicines are also disparate. For instance, chiropractic and osteopathic treatments are based on assumptions of vertebral misalignments interfering with body's functions while acupuncture is founded on beliefs of body's congruence maintained by balance of opposing energies "Yin" and "Yang" of the life force "Qi" (37, 38). Overall, with diverse backgrounds, different treatment philosophies, dissimilar training, and narrow scope of practice, this incongruent group of providers comprehend these disorders differently and offer dissimilar and often conflicting management recommendations for fundamentally the same conditions.

3.3. Disorderly Care and Un-Systematic Referrals

Coherent patient care rests firmly on accurate choice of providers and smooth transition of care from one provider to the other, practices which result in succinct patterns of referrals. Appropriate and well-timed referrals are critical for the patients with MSKDs as most treatments are beneficial only when provided opportunely in a timely manner. Factors determining referrals amongst generalists and specialists have been expounded upon previously exclusively in primary care settings and were found to be exceedingly complex (44). Even though referrals for infrequent pathological MSKDs such as tumors, inflammatory and traumatic lesions can be obvious, referrals for common degenerative and non-specific conditions, with

broad choices of providers treatments and care modalities to choose from, can be daunting. Moreover, though treatment guidelines for select MSKDs are available they are infrequently adhered to (6, 45). Consequently, coordination of care for patients with MSKDs is likely complex and factors determining referrals for these patients have not been systematically studied.

Referrals for patients with MSKDs customarily include initial referrals by the generalists or the patients themselves to the key specialists, typically an orthopedic or neurosurgeon, pain specialist, radiologist, PM&R physician, or a rheumatologist (46). The referral choices by the patients can be direct or indirect by influencing the decisions of the referring providers (47). Many patients, and some generalists, favor initial referrals to traditional and alternative care providers especially chiropractors osteopathic practitioners and acupuncturists citing intuitively the failure of treatments incident to modern western medicine (48). Facing the complex care decisions the generalists and the patients typically rely on the specialists for the ensuing and concomitant care (47, 48). However, most specialists employ predominantly their method of care and may not be abreast with the care rendered by practitioners of other and alternative methodologies (44, 47). In-fact, many specialists disapprove and may even eschew treatments by the rival providers (47). Consequently, the tentative care choices rendered by the generalists and the patients themselves, which are prone to a range of ancillary influences not necessarily linked to the patient care, can profoundly define the care received by these patients. Overall, the referrals provided to a large number of patients with MSKDs lack a systematic approach and depict inconsistent choices of providers and care modalities by the patients, generalists and the specialists alike.

The anomalous choices of care conferred can profoundly affect the costs and the quality of care afforded to these patients. Consulting multiple providers, often with extended wait times, is onerous and can be compounded by despair from dissimilar outlooks and variable treatment recommendations. Justifiably, many patients seek multiple opinions and may resort to unscientific, alternative and traditional methods of treatment (48). These exasperations however are insignificant compared to multiple other disconcerting consequences. For instance, selection of incongruous providers and therapies can result in suitable treatments being denied or not well-timed, delaying, or missing altogether, any opportunities for recovery, and erroneous and superfluous treatments may result in gratuitous complications. The high costs of care in these circumstances can be from unnecessary, extended and repetitive therapies, their complications, and the costs of treating advanced conditions resistant to conventional treatments

Table 2. "Conditions Treated" as Listed on Different Specialty Websites (39 - 43)

Chiropractic	Physical Therapy	Acupuncture	Pain Specialists	Orthopedic Surgeons
Back pain	Back pain	Rheumatic (rheumatoid) arthritis	Arthritis	ACL tear
Carpal tunnel	Compression fracture	Gout	Back pain	Knee pain
DDD	DJD	Sprain	Cancer pain	Meniscal tear
DJD	HD disc-related injuries	Tennis' elbow	Carpel tunnel syndrome	Patellar pain
Fibromyalgia	Neck pain	Periarthritis of shoulder	Chronic pain	Hip bursitis
Headaches	Nerve-compression	Lumbar strain	CRPS	Hip pain
OA	Spondylosis	Prolapse of lumbar vertebral disc	DDD	Piriformis syndrome
Piriformis Syndrome	Osteoporosis	Cervical spondylopathy	DPN	DDD
Radiculopathy	Sciatica	Stiff neck	Muscle injuries	Herniated disc
Sciatica	Spinal instability	Migraine headaches	Myofascial pain	Low back pain
Spondylolisthesis	Spinal stenosis	Neurosis	Fibromyalgia	Spinal stenosis
Whiplash	Spondylolisthesis	Neuralgia	Headaches	Torn disc
Subluxation	Sprains/strains	Sciatica	Herniated discs	Scoliosis
Car accident injuries	Thoracic outlet syndrome		Neck pain	Rotator cuff tear
Herniated disc	Whiplash and post-traumatic injuries	Facial spasm	Neuropathy	Frozen shoulder
Migraines	DDD	Facial paralysis	Orofacial pain	Shoulder pain
Sports injuries	Chondromalacia patella	Thecal cyst	Osteoporosis	Shoulder impingent

(49, 50).

One longstanding pattern of referral which must be debated distinctly is the referral of these to orthopedic and spine surgeons. Risk averse in disposition, this practice is likely based on the notion, shared equally by many patients and the generalists, that the preponderance of patients with MSKDs require a surgical treatment (51). Yet, the vast majority of patients with MSKDs require surgery only if expectant or conservative treatments have failed (4). In fact, inappropriate surgery may exacerbate patient's symptoms and may culminate in complications (5, 6). Referrals to spine surgeons is frequently provided, often emergently, due to the perceived risk of paralysis. Even though serious neurological deficits from common spinal conditions are infrequent and can be readily identified by pertinent patient evaluation (52). Hence, even though most such referrals can be avoided by enhanced understanding and meticulous patient assessment, spine and orthopedic surgery offices are inundated with patients who ultimately will not require surgery but instead will need suitable triage for their conservative care. Confronted with the cumbersome conservative care triage decisions these patients are often screened, based on variable criteria, by mid-level providers and trainees. Typically, an obligatory number of patients is selected for surgery while a large fraction is categorized as non-surgical candidates (53). At times, due to the overwhelming number of patients conferred at these practices

even the choice of surgery may even be ill-suited. For instance, an ardent surgeon may choose to intervene without giving natural recovery a reasonable chance and other similar tenuous incentives may constrict the treatment decisions. Consequently, the seemingly innocuous practice of routine referral of patients with MSKDs to orthopedic and spine surgeons may have unfavorable consequences for many of these patients.

3.4. Ancillary Factors Affecting Care Choices

The unsystematic care conferred is exceedingly susceptible to a host of extraneous influences not necessarily linked to the patient care. By influencing the choice of providers, treatments, methodologies, and the facilities selected, these ancillary factors can markedly, and often adversely, influence the care provided to these patients. Most notable among these are the commercial interests of many care participants including the providers, pharmaceutical companies, equipment makers, hospitals, clinics, and insurance companies. Utilizing diverse media and a contingent of sales personnel these sponsors avidly compete and market their products and services directly to the patients, referring providers, and the facilities (54). However, the endorsements are largely based on anecdotal claims of efficacy and any available research is generally of limited quality, sponsored in nature, or favors the products and services advertised (55). Proprietary and inter-

ventional treatments are conspicuously promoted while generic and conservative therapies, even when efficacious, are often ignored (56). “Novel” medical devices are often made promptly available, augmented by the amicable device approval process of the F.D.A. (57). Some providers are inventors, or have patented the interventions and devices, and hence benefit both from the direct use and the overall recommendation of these therapies (58). The third-party payers often deny reimbursements ostensibly due to the lack of necessity. However, these decisions are often rendered without direct patient or provider interaction by company employees with variable backgrounds often unfavorably affecting the care provided to these patients (59). A multitude of other ancillary factors can adversely affect care provided to these patients including procurement of opioids, disability claims and other social, legal, and psychological issues however their comprehensive discussion here would be unwieldy.

3.5. Ineffective and Non-Standardized Treatments

Contemporary treatments for most MSKDs cannot reverse or even apprehend the causative pathological processes and hence are inevitably unsuccessful. A complete review of the mechanisms and efficacy of these treatments is beyond the scope of this article, however, few commonly employed treatments for key MSKDs are briefly discussed (Table 3). Spinal fusion, first described in 1901, is performed universally for a range of spinal conditions with a large number performed for degenerative disc disease and spinal stenosis (60). The number of spinal fusions performed in the U.S. increased from 287,600 in 2001, to 488,300 in 2011 a 70% increase (61). Yet, it does not restore the degenerative disc processes and the multiple outcome studies report persistent pain and disability after the fusion surgery. Moreover, the outcomes degrade proportionate to the number of fusions performed and the vertebral levels fused (49, 62). Similarly, almost half a million discectomies and laminectomies are performed each year in U.S. alone. However, these procedures also do not resolve the degenerative disc processes and may instead accelerate disc degeneration causing long-term pain and disability (50, 61). Persistent pain and disability is common after interventions for many MSKDs but is ubiquitous after spine surgery to a point where distinct ICD-10 codes are assigned expressly to this anomaly (49). Suspected tendinitis and tears of the rotator cuff are the most common shoulder conditions for which patients seek medical attention (20). The number of arthroscopic rotator cuff repair surgeries performed in the U.S. increased from 8/100,000 in 1996, to 58/100,000 in 2006 a 600% increase (63). Yet, these procedures do not ameliorate the antecedent tendon pathologies, are not supported by well-designed stud-

ies, and in contrast recent clinical trials show their overall inefficacy (64, 65). Knee osteoarthritis (OA) is the most common arthritic condition and is frequently preceded by meniscal and ligament knee pathologies (66). Knee arthroscopy is routinely performed for the diagnosis and treatment of knee OA and the precursor meniscal and ligament conditions (67). In 2006, just in the outpatient settings, 984,607 knee arthroscopies were performed in the U.S. and their number increased by 49% between 1996 and 2006 (68). Yet, these procedures do not alter the pathological course of knee OA, and the multiple outcome studies show that the results of these procedures are similar to sham interventions (67). The intuitive nature of the traditional and alternative modalities including chiropractic, osteopathy, and acupuncture were discussed earlier and despite the abundance of insular literature their efficacy is not evident in the carefully designed studies (69, 70). The lack of effective treatments augmented by the syndrome-based approach to the diagnosis favors symptomatic therapies which henceforth are the mainstay treatments for many MSKDs. The list of these therapies is extensive and only a few can be enumerated:

Medications: Opioids, membrane stabilizers, neurotransmitter re-uptake inhibitors, neuroleptics, muscle relaxers, topical anesthetics, counter irritants;

Physical therapy modalities: Infrared therapies, cryotherapies, braces, traction devices, magnets, mirror therapy, aqua-therapy;

Minimally invasive treatments: Spinal cord and dorsal ganglion stimulation, IDET, X-STOP, MILD procedure;

Psychological therapies: Cognitive behavioral therapy, biofeedback;

And a range of surgeries: Arthroscopic debridements, spinal fusion.

Even when effective, the relief provided by these therapies is often partial and time constrained with ultimate failure of treatments and return of symptoms as the underlying pathological processes inexorable progress and cause irrevocable damage to the related musculoskeletal structures (71). For example, hip and knee arthroplasties are routinely performed for OA affecting the respective joints and are considered highly successful; 427,181 hip and knee arthroplasties were performed between 2012 and 2015 in the U.S. (72). Yet, these surgeries do not arrest the degradation of these joints and their ostensible success is undermined regularly by their time contingent longevity, complications and often the inadequate symptomatic relief (73). Most notable however is the variable perception of these syndromes by the heterogeneous group of providers which results in disparate and remarkably dissimilar treatment strategies. Hence, presented with analogous conditions the choice, timing, and the necessity of the recom-

mended interventions can be markedly different. Compounding these treatment anomalies is the propensity for extended care and repetitive treatments by the individual providers and consequently the therapies are often continued without clear benefits, and sometimes despite adverse effects.

3.6. Lack of Preventative Care

A range of genetic predispositions and environmental risk factors play a key role in the inception and perpetuation of most MSKDs (32, 75). Correspondingly, though many musculoskeletal injuries are unintended, and hence unavoidable, the majority are the result of predictable high impact or repetitive insults linked to specific work environments and high-risk lifestyles. Consequently, clear recognition, and augmentation of these risk factors can prevent the majority of MSKDs. For example, OA, the leading cause of pain and disability worldwide, is predisposed to by a variety of environmental risk factors, which include advancing age (76), obesity (77), exposure to high levels of joint loading (78), and previous joint injury (79). Similarly, environmental risk factors play a crucial role in the onset and evolution of most low back and neck pain disorders. The delicate metabolic milieu of the IVD (17) induces it to premature degeneration by a range of risk factors including disproportionate and recurrent disc loading (18), poor posture (80), obesity, and smoking (81). These risk factors are predisposed to by a range of high intensity sports (82) and occupations (83). Similarly, soft tissue injuries to ligaments, tendons, and cartilages, especially those connected to knee, hip and shoulder joints, can cause enduring pain, disability, and culminate in early OA (84-86). Myofascial pain, another common soft tissue-related source of chronic pain, is triggered by postural and other aberrant and repetitive work and lifestyle-related activities (24). Hence a multitude of environmental risk factors linked to lifestyles, work environments, dietary and other individual actions play a crucial role in the inception, propagation and sustainment of most MSKDs. Even though broad preventative measures such as improving dietary habits, reducing obesity, averting sedentary lifestyles, preventing smoking, avoiding high impact and repetitive lifestyle related activities, and mandating apposite work place environments are regularly advocated they are substantiated by insufficient research and hence are at best tenuous (87). Furthermore, whereas tremendous attention is routinely devoted to the advent of exorbitant therapies relatively little consideration is given to develop and institute strategies for the prevention of these conditions (87).

4. Recommendations for Improvement

4.1. Strategies for Prevention, Early Diagnosis, and Treatment

The existing comprehension of the biological dysfunctions responsible for pain and disability linked to the musculoskeletal system must be enhanced. Specifically, future research should further explore the molecular and cellular mechanisms responsible for IVD degeneration, OA, myofascial pain, fibromyalgia, CRPS and the various myofascial, ligamentous, and cartilaginous dysfunctions. Explicit understanding of the pathological underpinnings of these disorders may permit their re-cataloging based on etiology and pathology an approach which may facilitate their prevention and early recognition (88). Viable treatments which can emphatically arrest and reverse the causal processes must be conceived. The various national and industry sponsored resources must commit to inquiries pursuing these goals. Clear correlations between the putative etiological factors and the corresponding clinical syndromes must be established and supplant the existing fragile links. Categorical delineation of the causative genetic, acquired, and environmental risk factors would allow exhortation of clear preventative strategies to halt initiation and perpetuation of these conditions. Once expounded these preventative strategies must be emphasized in the perspective management protocols. Screening by non-invasive laboratory biomarker and genetic-based tests, capable of early identification of the causal processes, must eschew the current diagnostic modalities discerning mainly their aftermaths. Adoption of concrete preemptive measures, early recognition of the causal processes, and their timely treatment by disease altering therapies may remedy these conditions before irrevocable destructive changes are cemented and may lessen their staggering toll.

4.2. Strategies for Streamlining Care

Care delivery to patients with MSKDs must be systematic and consistent based on evidence and consensus (89). Management protocols, assessed, scrutinized, approved and propagated by the respective bodies involved in the care of these patients must be adhered to. These management strategies must focus on prevention early and effective treatment and reduced dependence on palliative therapies; especially the opioid medications. The management protocols must also focus on reducing disability, improving function, and on back to work initiatives. A proposal to create a subspecialty of practitioners proficient in all aspects of care of these patients who are not motivated to carry out procedures and interventions may be considered. Providers from disciplines such as family medicine, internal medicine, PM&R and neurology could be trained

Table 3. Brief Analysis of Commonly Employed Treatments for Key MSKDs

Intervention	Description and Prevalence	Utility and Efficacy
Spinal fusion	First described in 1901 and commonly performed for a range of spinal conditions including degenerative disc disease and spinal stenosis (60).	Multiple studies continue to report persistent pain and disability after spinal fusion surgery (62).
	The number of spinal fusion performed in the U.S. increased from 287,600 in 2001 to 488,300 in 2011 a 70% increase (61).	Outcomes degrade with the number of fusions performed and the levels fused.
Discectomy and laminectomy	Almost half a million laminectomies are performed in U.S. each year (61).	Both discectomy and laminectomy can cause long-term pain and disability (50).
Rotator cuff surgery	Rotator cuff problems are second most common MSKDs after low back pain (74).	Lack of well-designed studies supporting these interventions (64).
	A 600% increase in rotator cuff surgeries from 1996 to 2006 (63).	Recent RCT suggested overall inefficacy of these interventions (65).
Knee arthroscopies	Knees OA is the most common osteoarthritic condition	Multiple outcome studies indicate the results of therapeutic knee arthroscopies similar to sham procedures (67).
	Meniscal and ligamental knee injuries frequent precursor to knee OA	
	Knee arthroscopy routinely performed for these conditions (66).	
	Number of knee arthroscopies increased by 49% between 1996 and 2006 (68).	
Hip and knee arthroplasties	427,181 hip and knee arthroplasties performed between 2012 and 2015 (72).	Hip and knee arthroplasties are costly, invasive, carry high risk of complications, have durability concerns (73).
Traditional	44,400 chiropractors (2012) practicing in the U.S.	No scientific basis for these therapies.
Therapies	27,965 acupuncturists (2009) practicing in the U.S.	Multiple studies indicate lack of their efficacy (69, 70).

in comprehensive care of all aspects of MSKDs. These experts could perceptibly compare the various treatment options and make objective and unambiguous care recommendations. For instances, suggestions for a specific physical therapy modality, injection, minimally invasive intervention, or a surgical option must be clear. These providers must also provide uninterrupted treatment surveillance as the conditions evolve procure services of additional specialists when necessary and determine the precise activity and work restrictions.

4.3. Policy Recommendations

To reduce the impact of ancillary factors reimbursements for new interventions could be limited to those endorsed by a panel of independent experts not directly linked to their procurement or development. Similarly, the ongoing use of various therapies, interventions, and devices could be monitored and those not supported by contemporaneous research could be re-evaluated. The off-label use of the devices and drugs must be scrutinized denoted as experimental and supported only by investigational resources. The influx of commercially motivated interventions can be confined by adhering to evidenced and

consensus-based approach discussed above and by oversight of the promotional materials and marketing strategies. Use of unscientific therapies could be limited or at a minimum the users warned of their unscientific nature potential dangers and lack of efficacy. Congruently, rejection of reimbursements for rigorously evaluated and endorsed treatments should be discouraged, and any suspected disproportionate or inappropriate use of these treatments, and tests, can be disclosed to and investigated by the pertinent agencies.

5. Conclusions

Musculoskeletal disorders are a chief source of pain and disability. This article attempts to highlight the significant problems with the care of patients with musculoskeletal disorders citing their care in the U.S. as an example. However, these problems are global in scope. The observations and the preliminary recommendations made in this article may help improve the overall care of patients with MSKDs and may reduce the global incidence of unscathed pain and disability.

Supplementary Material

Supplementary material(s) is available [here](#) [To read supplementary materials, please refer to the journal website and open PDF/HTML].

Footnotes

Authors' Contribution: Khalid M Malik gave the original idea and wrote the paper, Rena Beckerly helped with data, Farnad Imani helped with data.

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