



Louisiana

Neurodiagnostics

Policy # 00186

Original Effective Date: 05/15/2006

Current Effective Date: 10/14/2024

Applies to all products administered or underwritten by Blue Cross and Blue Shield of Louisiana and its subsidiary, HMO Louisiana, Inc. (collectively referred to as the "Company"), unless otherwise provided in the applicable contract. Medical technology is constantly evolving, and we reserve the right to review and update Medical Policy periodically.

When Services Are Eligible for Coverage

Coverage for eligible medical treatments or procedures, drugs, devices or biological products may be provided only if:

- *Benefits are available in the member's contract/certificate, and*
- *Medical necessity criteria and guidelines are met.*

Electromyography and Nerve Conduction Studies

Based on review of available data, the Company may consider electrodiagnostic assessment, consisting of electromyography, nerve conduction studies, and related measures as an adjunct to history, physical exam, and imaging studies when the following criteria are met to be **eligible for coverage:****

- Signs and symptoms of peripheral neuropathy and/or myopathy are present; and
- Definitive diagnosis cannot be made by physical exam and imaging studies alone; and
- Work-up for one or more of the following categories of disease is indicated
 - Nerve root compression,
 - Traumatic nerve injuries,
 - Generalized and focal neuropathies/myopathies,
 - Plexopathies,
 - Motor neuron diseases,
 - Neuromuscular junction disorders, or
 - Compressive neuropathies.

Based on review of available data, the Company may consider a repeat electrodiagnostic assessment when at least one of the following criteria has been met to be **eligible for coverage:****

- Development of new symptoms or signs suggesting a second diagnosis in a patient who has received an initial diagnosis; or
- Interim progression of disease following an initial test that was inconclusive, such that a repeat test is likely to elicit additional findings; or

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- Unexpected change(s) in the course of disease or response to treatment, suggesting that the initial diagnosis may be incorrect and that reexamination is indicated.

When Services Are Considered Not Medically Necessary

Needle electromyography, which uses invasive needle electrodes, must be performed by a physician specifically trained in electrodiagnostic medicine, such as a doctor of medicine, doctor of osteopathy specializing in neurology or physical and rehabilitation medicine, or other provider specialties that have documented specific training in the use of NEMG. The Company considers NEMG to be **not medically necessary**** if not directly performed and interpreted by the physician or another specifically trained provider.

Nerve conduction studies should be either (a) performed directly by the physician or (b) performed by a trained individual under the direct supervision of the physician. The Company considers NCSs to be **not medically necessary**** if not performed either by the physician or a trained individual under his direct supervision. Direct supervision is defined by the American Association of Electrodiagnostic Medicine (AAEM) to mean that the physician trained in electrodiagnostic (EDX) medicine is in close physical proximity to the EDX laboratory while testing is underway, is immediately available to provide the trained individual with assistance and direction, and is responsible for selecting the appropriate studies to be performed.

Generally, the interpreting physician for both NEMG and NCS procedures should be a neurologist or physiatrist or physician with comparable supervised training within a residency or fellowship training program.

When Services Are Considered Investigational

Coverage is not available for investigational medical treatments or procedures, drugs, devices or biological products.

Electromyography and Nerve Conduction Studies

Based on review of available data, the Company considers electrodiagnostic assessment, consisting of electromyography, nerve conduction study, and related measures when the above criteria are not met, including but not limited to, the following situations to be **investigational:***

- Screening of asymptomatic individuals

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- Serial assessments to evaluate progression of disease in a patient with a previously diagnosed neuropathy or myopathy
- Evaluation of treatment response in an individual with previously diagnosed neuropathy or myopathy
- Evaluation of severity of disease in a patient with previously diagnosed neuropathy or myopathy
- Macro electromyography (EMG)
- Current perception threshold (CPT)
- Pressure specified sensory testing

Automated Point-of-Care Nerve Conduction Tests

Based on review of available data, the Company considers automated point-of-care nerve conduction tests to be **investigational**.*

Quantitative Sensory Testing

Based on review of available data, the Company considers quantitative sensory testing, including but not limited to current perception threshold testing, pressure-specified sensory device testing, vibration perception threshold testing, and thermal threshold testing to be **investigational**.*

Paraspinal Surface Electromyography (SEMG) to Evaluate and Monitor Back Pain

Based on review of available data, the Company considers paraspinal surface electromyography as a technique to diagnose or monitor back pain to be **investigational**.*

Policy Guidelines

Electromyography and Nerve Conduction Studies

The following list gives specific diagnoses, according to categories of testing listed in the policy statement, for which electromyography (EMG) and nerve conduction study (NCS) generally provide useful information in confirming or excluding the diagnosis, above that provided by clinical examination and imaging. The list includes the most common diagnoses for testing, but is not exhaustive. There may also be less common disorders for which EMG/NCS provide useful diagnostic information.

- Compressive neuropathies

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- Carpal tunnel syndrome
 - Ulnar nerve entrapment
 - Thoracic outlet syndrome
 - Tarsal tunnel syndrome
 - Other peripheral nerve entrapments
- Nerve root compression (when physical exam and magnetic resonance imaging are inconclusive):
 - Cervical nerve root compression
 - Thoracic nerve root compression
 - Lumbosacral nerve root compression
- Traumatic nerve injuries
- Generalized and focal polyneuropathies:
 - Diabetic neuropathy
 - Uremic neuropathy
 - Alcohol-related neuropathy
 - Hereditary neuropathies:
 - Charcot-Marie-Tooth
 - Other hereditary neuropathies
 - Demyelinating polyneuropathies:
 - Guillain-Barré syndrome (acute)
 - Chronic idiopathic demyelinating polyneuropathy
- Generalized myopathies:
 - Polymyositis
 - Dermatomyositis
 - Muscular dystrophies
- Plexopathies:
 - Cervical plexopathy
 - Brachial plexopathy
 - Lumbosacral plexopathy
- Motor neuron diseases:
 - Amyotrophic lateral sclerosis
 - Progressive muscular atrophy
 - Progressive bulbar palsy

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- Pseudobulbar palsy
- Primary lateral sclerosis
- Neuromuscular junction disorders:
 - Myasthenia gravis
 - Myasthenic syndrome
 - Lambert-Eaton syndrome.

The following recommendations on the number of repeat services are reproduced from the American Association of Neuromuscular & Electrodiagnostic Medicine (AANEM) position statement (2023). These estimates do not represent absolute maximums for all individuals; they are defined by AANEM as being sufficient to make a diagnosis in at least 90% of individuals with that particular diagnosis. Therefore, there may be a small percentage of cases that require a greater number of tests than specified in Table PG1.

Table PG1. Recommended Maximum Number of Electrodiagnostic Studies for Specific Diagnoses

Indication	Needle EMG	NCSs		Other Studies
		No. of Tests	No. of Tests	RNS Testing
Carpal tunnel (unilateral)	1	7		0
Carpal tunnel (bilateral)	2	10		0
Radiculopathy	2	7		0
Mononeuropathy	1	8		0
Polyneuropathy or mononeuropathy multiplex	3	10		0
Myopathy	2	4		2
Motor neuropathy (eg, amyotrophic lateral sclerosis)	4	6		2
Plexopathy	2	12		0

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Indication	Needle EMG	NCSs	Other Studies
Neuromuscular junction	2	2	3
Tarsal tunnel syndrome (unilateral)	1	8	0
Tarsal tunnel syndrome (bilateral)	2	11	0
Weakness, fatigue, cramps, or twitching (focal)	2	7	2
Weakness, fatigue, cramps, or twitching (general)	4	8	2
Pain, numbness, or tingling (unilateral)	1	9	0
Pain, numbness, or tingling (bilateral)	2	12	0

Adapted from American Association of Neuromuscular & Electrodiagnostic Medicine (2023). EMG: electromyography; NCS: nerve conduction studies; RNS: repetitive nerve stimulation.

The AANEM position statement (2023) also included minimum standards for a lab performing electrodiagnostic evaluation:

- The tests should be medically indicated.
- The tests should be performed using equipment that provides an assessment of all parameters of the recorded signals. Equipment designed for screening purposes is not acceptable.
- The number of tests performed should be the minimum needed to establish an accurate diagnosis.
- The NCS should be performed by a physician or by a trained individual under the direct supervision of a physician.
- A trained physician must perform the needle EMG exam.
- One physician should perform and supervise all components of the electrodiagnostic testing and all testing should occur on the same date of service.
- The NCS and needle EMG exam results should be integrated into a unifying report and diagnostic impression.

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Background/Overview

Electromyography and Nerve Conduction Studies

ELECTRODIAGNOSTIC ASSESSMENT

Electromyography (EMG) and nerve conduction studies (NCS) are used as adjuncts to clinical evaluation of myopathy and peripheral neuropathy. These tests intend to evaluate the integrity and electrical function of muscles and peripheral nerves. They are performed when there is clinical suspicion for a myopathic or neuropathic process and when clinical examination and standard laboratory testing cannot make a definitive diagnosis.

Test results do not generally provide a specific diagnosis. Rather, they provide additional information that assists physicians in characterizing a clinical syndrome. EMG/NCS may be useful when there is no clear etiology when symptoms are severe or rapidly progressing, or when symptoms are atypical (eg, asymmetrical, acute onset, or appearing to be autonomic).

According to the American Association of Neuromuscular & Electrodiagnostic Medicine (2023), electrodiagnostic assessment has the following goals.

1. "Identify normal and abnormal nerve, muscle, motor or sensory neuron, and NMJ [neuromuscular junction] functioning.
2. Localize region(s) of pathology.
3. Characterize the pathology.
4. Determine the distribution of abnormalities.
5. Determine the severity of abnormalities.
6. Estimate the chronology of the disease.
7. Determine the progression and/or recovery from abnormal function.
8. Aid in diagnosis and prognosis of the disease.
9. Aid in selecting treatment options.
10. Aid in following response to treatment by providing objective evidence of change in NM [neuromuscular] function.
11. Localize correct locations for injections of intramuscular agents..."

Components of the electrodiagnostic exam may include needle EMG, NCS, repetitive nerve stimulation study, somatosensory evoked potentials, and blink reflexes.

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Electromyography

Needle Electromyography

An EMG needle electrode is inserted into selected muscles, chosen by the examining physician depending on the differential diagnosis and other information available during the exam. The response of the muscle to electrical stimulation is recorded. Three components are evaluated: observation at rest, action potential with minimal voluntary contraction, and action potential with maximum contraction.

Single Fiber Electromyography

In single-fiber EMG, a needle electrode records the response of a single muscle fiber. This test can evaluate "jitter," which is defined as the variability in the time between activation of the nerve and generation of the muscle action potential. Single fiber EMG can also measure fiber density, which is defined as the mean number of muscle fibers for 1 motor unit.

Nerve Conduction Studies

In NCS, both motor and sensory nerve conduction are assessed. For motor conduction, electrical stimuli are delivered along various points on the nerve, and the electrical response is recorded from the appropriate muscle. For sensory conduction, electrical stimuli are delivered to 1 point on the nerve, and the response is recorded at a distal point on the nerve. Parameters recorded include velocity, amplitude, latency, and configuration.

Late Wave Responses

Late waves are a complement to the basic NCS and evaluate the functioning of the proximal segment of peripheral nerves, such as the nerve root and the anterior horn cells. There are 2 types of late responses: the H-reflex and the F wave.

The H-reflex is elicited by stimulating the posterior tibial nerve and measuring the response in the gastrocnemius muscle. It is analogous to the ankle reflex and can be prolonged by radiculopathy at S1 or by peripheral neuropathy.

The F wave is assessed by supramaximal stimulation of the distal nerve and can help estimate the conduction velocity in the proximal portion of the nerve. This will provide information on the presence of proximal nerve abnormalities, such as radiculopathy or plexopathy.

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Repetitive Nerve Stimulation

Repetitive nerve stimulation studies evaluate the integrity and function of the neuromuscular junction. The test involves stimulating a nerve repetitively at variable rates and recording the response of the corresponding muscle(s). Disorders of the neuromuscular junction will show a diminished muscular response to repetitive stimulation.

Somatosensory Evoked Potentials

Somatosensory evoked potentials evaluate nerve conduction in various sensory fibers of both the peripheral and central nervous system and test the integrity and function of these nerve pathways. They are typically used to assess nerve conduction in the spinal cord and other central pathways that cannot be assessed by standard NCS.

Blink Reflexes

The blink reflexes, which are analogs of the corneal reflex, are evaluated by stimulating the orbicularis oculi muscle at the lower eyelid. They are used to localize lesions in the fifth or seventh cranial nerves.

Differential Diagnosis

The specific components of an individual test are not standardized. Rather, a differential diagnosis is developed by the treating physician, and/or the clinician performing the test, and the specific components of the exam are determined by the disorders being considered in the differential. Also, the differential diagnosis may be modified during the exam to reflect initial findings, and this may also influence the specific components included in the final analysis.

Automated Point-of-Care Nerve Conduction Tests

ELECTRODIAGNOSTIC TESTING

NCSs and needle EMG, when properly performed by a trained practitioner, are considered the criterion standard of electrodiagnostic testing for the evaluation of focal and generalized disorders of peripheral nerves. However, the need for specialized equipment and personnel may limit the availability of electrodiagnostic testing for some individuals.

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CARPAL TUNNEL SYNDROME

Carpal tunnel syndrome is a pressure-induced entrapment neuropathy of the median nerve as it passes through the carpal tunnel, resulting in sensorimotor disturbances. This syndrome is defined by its characteristic clinical symptoms, which may include pain, subjective feelings of swelling, and nocturnal paresthesia.

Diagnosis

A variety of simple diagnostic tools are available, and a positive response to conservative management (steroid injection, splints, modification of activity) can confirm the clinical diagnosis. Electrodiagnostic studies may also be used to confirm the presence or absence of median neuropathy at the wrist, assess the severity of the neuropathy, and assess associated diagnoses. Nerve conduction is typically assessed before the surgical release of the carpal tunnel, but the use of EMG in the diagnosis of carpal tunnel syndrome is controversial. One proposed use of automated nerve conduction devices is to assist in the diagnosis of carpal tunnel syndrome.

LUMBOSACRAL RADICULOPATHY

Electrodiagnostic studies are useful in the evaluation of lumbosacral radiculopathy in the presence of disabling symptoms of radiculopathy or neuromuscular weakness. These tests are most commonly considered in individuals with persistent disabling symptoms when neuroimaging findings are inconsistent with clinical presentation. Comparisons of automated point-of-care (POC) NCSs with EMGs and standardized NCSs have been evaluated as alternative electrodiagnostic tools.

PERIPHERAL NEUROPATHY

Peripheral neuropathy is relatively common in individuals with diabetes, and the diagnosis is often made clinically through the physical examination. Diabetic peripheral neuropathy can lead to morbidity including pain, foot deformity, and foot ulceration.

Diagnosis

Clinical practice guidelines have recommended using simple sensory tools such as the 10-g Semmes-Weinstein monofilament or the 128-Hz vibration tuning fork for diagnosis. These simple tests predict the presence of neuropathy defined by electrophysiologic criteria with a high level of accuracy. Electrophysiologic testing may be used in research studies and may be required in cases with an atypical presentation. POC nerve conduction testing has been proposed as an alternative to

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standard electrodiagnostic methods for the diagnosis of peripheral neuropathy and, in particular, for detecting neuropathy in individuals with diabetes.

Normative Values

NeuroMetrix (2009) published reference ranges for key nerve conduction parameters in healthy subjects. Data analyzed were pooled from 5 studies, including from 92 to 848 healthy subjects with data on the median, ulnar, peroneal, tibial, and sural nerves. Subject age and height were found to affect the parameters. In addition to providing reference ranges for clinicians to use (providing that NCS techniques are consistent with those described in the article), the authors stated that clinicians could use the same method to develop their reference ranges. At this time, the proposed reference ranges have not been validated in a clinical patient population.

Due to the lack of uniform standards in nerve conduction testing in the United States, the American Association of Neuromuscular & Electrodiagnostic Medicine (AANEM) identified 7 criteria that would identify high-quality NCS articles that would be appropriate for using as reference standards (2016). AANEM identified normative criteria for nerve conduction velocity tests based on a review of high-quality published studies (see Table 1). In March 2017, the American Academy of Neurology affirmed AANEM's recommendations.

Table 1. Criteria for Evaluating Published Sources for Normative Standards

Criteria	Description
Year published	Published during or after 1990, written in or translated from other languages into English
Sample size	>100 normal subjects
Subjects	Inclusion and exclusion criteria must be methodologically sound and reflect a true "normal" group of asymptomatic individuals
Testing factors	Use of digital electromyographic equipment Methods of temperature control stated

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	<p>Testing techniques with electrode placement and distances between simulating and recording electrodes specified</p> <p>Filter settings specified</p> <p>Screen display parameters (milliseconds per division, microvolts/millivolts per division) specified</p>
Age	Wide distribution of subject ages >18 years with adequate sampling of the elderly
Statistical analyses	<p>Data distribution should be described, and appropriate statistical methods used to account for non-Gaussian distributions</p> <p>Cutoff values expressed and derived as percentiles of the distribution (the preferred method)</p> <p>Percentage of subjects who have an absent response should be reported</p>
Data presentation	Reference values and cutoff points for NCS parameters clearly presented in a useful format

Adapted from Dillingham et al (2016).
NCS: nerve conduction study.

Chen (2016) published reference values for upper and lower NCSs in adults, as a companion study to the Dillingham et al (2016) report (above), to address the need for greater standardization in the field of electrodiagnostic medicine. Using the consensus-based criteria developed by AANEM, a comprehensive literature search was conducted for 11 routinely performed sensory and motor NCS from 1990 to 2012. Over 7500 articles were found, but after review, a single acceptable study meeting all criteria was identified for the 11 nerves. Reviewers determined there were multifactorial reasons that so few studies met the criteria. Large-scale normative studies are time intensive, requiring significant resources and cost. Data from many studies did not address the non-Gaussian distribution of NCS parameters and often derived cutoff values using the mean and standard deviations rather than percentiles.

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Quantitative Sensory Testing Nerve Damage and Disease

Nerve damage and nerve diseases can reduce functional capacity and lead to neuropathic pain. There are also racial and ethnic disparities due to biological factors as well as social and environmental contributors in diseases that can lead to neuropathic pain.¹ For example, incidence of neuropathy due to diabetic microvascular complications is higher in minority populations compared to non-Hispanic Whites.

Treatment

There is a need for tests that can objectively measure sensory thresholds. Moreover, quantitative sensory testing (QST) could aid in the early diagnosis of disease. Also, although the criterion standard for evaluation of myelinated, large fibers is electromyography nerve conduction study, there are no criterion standard reference tests to diagnose small fiber dysfunction.

Quantitative Sensory Testing

Quantitative sensory test systems measure and quantify the amount of physical stimuli required for sensory perception to occur. As sensory deficits increase, the perception threshold of QST will increase, which may be informative in documenting the progression of neurologic damage or disease. Currently, QST has not been established for use as a sole tool for diagnosis and management but has been used with standard evaluative and management procedures (eg, physical and neurologic examination, monofilament testing, pinprick, grip and pinch strength, Tinel sign, and Phalen and Roos test) to enhance the diagnosis and treatment-planning process, and to confirm physical findings with quantifiable data. Stimuli used in QST include touch, pressure, pain, thermal (warm and cold), or vibratory stimuli.

The criterion standard for evaluation of myelinated, large fibers is the electromyography nerve conduction study. However, the function of smaller myelinated and unmyelinated sensory nerves, which may show pathologic changes before the involvement of the motor nerves, cannot be detected by nerve conduction studies. Small fiber neuropathy has traditionally been a diagnosis of exclusion in patients who have symptoms of distal neuropathy and a negative nerve conduction study.

Depending on the type of stimuli used, QST can assess both small and large fiber dysfunction. Touch and vibration measure the function of large myelinated A alpha and A beta sensory fibers. Thermal stimulation devices are used to evaluate pathology of small myelinated and unmyelinated nerve

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fibers; they can be used to assess heat and cold sensation, as well as thermal pain thresholds. Pressure-specified sensory devices assess large myelinated sensory nerve function by quantifying the thresholds of pressure detected with light, static, and moving touch. Finally, current perception threshold testing involves the quantification of the sensory threshold to transcutaneous electrical stimulation. In current perception threshold testing, typically 3 frequencies are tested: 5 Hz, designed to assess C fibers; 250 Hz, designed to assess A delta fibers; and 2000 Hz, designed to assess A beta fibers. Results are compared with those of a reference population.

Because QST combines the objective physical, sensory stimuli with the subject patient response, it is psychophysical and requires patients who are alert, able to follow directions, and cooperative. Also, to get reliable results, examinations need to include standardized instructions to the patients, and stimuli must be applied consistently by trained staff. Psychophysical tests have greater inherent variability, making their results more difficult to reproduce.

Primarily, QST has been applied in patients with conditions associated with nerve damage and neuropathic pain. A retrospective analysis of a prospective database maintained by the German Research Network on Neuropathic Pain by Forstenpointner et al (2021) compared QST profiles between patients with painful neuropathic conditions (n=332), patients with neuropathic conditions who did not report pain (n=111), and healthy controls (n=112). After extensive QST testing, including thermal, mechanical/vibration, and pain sensitivity, the researchers found similar QST profiles between patients who reported pain and patients who did not report pain, which raises concern about the role of QST in general in decision-making for neuropathic conditions. There have also been preliminary investigations to identify sensory deficits associated with conditions such as autism spectrum disorder, Tourette syndrome, restless legs syndrome, musculoskeletal pain, and response to opioid treatment.

Paraspinal Surface Electromyography (SEMG) to Evaluate and Monitor Back Pain

BACK PAIN

Back pain is a common condition that affects most individuals at some point in their lives. Identifying the pathogenesis of back pain is challenging, in part due to the complex anatomy of the back, which includes vertebrae, intervertebral discs, facet joints, spinal nerve roots, and numerous muscles. Back pain may be related to osteoarthritis, disc disease, subluxation, or muscular pathologies, such as muscle strain or spasm. Moreover, due to referred pain patterns, the location of

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the pain may not be anatomically related to the pathogenesis of the pain. For example, buttock or leg pain may be related to pathology in the spine. In addition to the diagnostic challenges of back pain is the natural history of acute back pain.

Diagnosis

Aside from physical examination, diagnostic testing includes imaging technologies, such as magnetic resonance imaging, designed to identify pathology (eg, bulging discs), or tests such as discography to localize the abnormality by reproducing the pain syndrome. However, these tests lack specificity and must be carefully interpreted in the context of the clinical picture. For example, magnetic resonance imaging identifies 5% of asymptomatic patients as having bulging discs. However, the presence of a bulging disc may only be clinically significant if correlated with other symptoms. Assessment of the musculature may focus on a range of motion or strength exercises.

In contrast to anatomic imaging, surface electromyography (SEMG), which records the summation of muscle activity from groups of muscles, has been investigated as a technique to evaluate the physiologic functioning of the back. A noninvasive procedure, SEMG differs from needle electromyography, an invasive procedure in which the electrical activity of individual muscles is recorded. Paraspinal SEMG has been explored to evaluate abnormal patterns of electrical activity in the paraspinal muscles in patients with back pain symptoms such as spasm, tenderness, limited range of motion, or postural disorders. The technique is performed using a single or an array of electrodes placed on the skin surface, with recordings made at rest, in various positions, or after a series of exercises. Recordings can also be made by using a handheld device, which is applied to the skin at different sites. Electrical activity is assessed by computer analysis of the frequency spectrum (ie, spectral analysis), amplitude, or root mean square of the electrical action potentials. In particular, a spectral analysis that focuses on the median frequency has been used to assess paraspinal muscle fatigue during isometric endurance exercises. Paraspinal SEMG has been researched as a technique to establish the etiology of back pain and has been used to monitor the response to therapy and establish physical activity limits, such as assessing capacity to lift heavy objects or ability to return to work.

Paraspinal SEMG is an office-based procedure. The following clinical applications of the paraspinal SEMG have been proposed:

- clarification of diagnosis (ie, muscle, joint, or disc disease)
- selection of a course of medical therapy

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- selection of a type of physical therapy
- preoperative evaluation
- postoperative rehabilitation
- follow-up of acute low back pain (LBP)
- evaluation of exacerbation of chronic LBP
- evaluation of pain management treatment techniques.

Treatment

Most cases of acute LBP resolve with conservative therapy (eg, physical therapy) while continuing normal activities within limits permitted by the pain. Therefore, initial imaging or other diagnostic testing is generally not recommended unless "red flag" warning signs are present or the pain persists for more than 4 to 6 weeks. Red flag findings include significant trauma, history of cancer, unrelenting night pain, fevers or chills, and progressive motor or sensory deficits.

FDA or Other Governmental Regulatory Approval

U.S. Food and Drug Administration (FDA)

Electromyography and Nerve Conduction Studies

EMG/NCS measure nerve and muscle function and may be indicated when evaluating limb pain, weakness related to possible spinal nerve compression, or other neurologic injury or disorder. A number of electromyographic devices have received marketing clearance from the U.S. Food and Drug Administration. Several devices are listed in Table 2.

Table 2. Electromyographic Devices Approved by the U.S. Food and Drug Administration

Device	Manufacturer	Food and Drug Administration Clearance	510(k) No.	Food and Drug Administration Product Code
NuVasive [®] NVM5 System	NuVasive	2011	K112718	ETN
CERSR [®] Electromyography System	SpineMatrix	2011	K110048	IKN
CareFusion Nicolet [®] EDX	CareFusion 209	2012	K120979	GWF

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Physical Monitoring Registration Unit-S (PMRU-S)	Oktx	2013	K123902	IKN
MyoVision 3G Wirefree™ ‡System	Precision Biometrics	2013	K123399	IKN
Neuro Omega™‡ System	Alpha Omega Engineering	2013	K123796	GZL
EPAD™‡	SafeOp Surgical	2014	K132616	GWF
Sierra Summit, Sierra Ascent	Cadwell Industries	2017	K162383	IKN, GWF
EPAD 2™‡	SafeOp Surgical	2019	K182542	GWF, IKN
Mediracer®‡ NCS	Mediracer	2019	K190536	JXE, IKN
Mega-TMS™‡	Soterix Medical, Inc.	2021	K192823	GWF, JXE

Automated Point-of-Care Nerve Conduction Tests

Multiple devices have been cleared for POC neural conduction testing. For example, in 1986, Neurometer®‡ CPT/C (Neurotron®)‡ was cleared for marketing by the U.S. FDA through the 510(k) process (K853608). The device evaluates and documents sensory nerve impairments at cutaneous or mucosal sites. The evaluation detects and quantifies hyperesthesia in early stages of progressive neuropathy and hypoesthesia in more advanced conditions.

In 1998 NC-stat®‡ (NeuroMetrix) was cleared by FDA through the 510(k) process (K982359). NC-stat is intended “to measure neuromuscular signals that are useful in diagnosing and evaluating systemic and entrapment neuropathies.” This version is no longer commercially available. It is the predicate device for the NC-stat DPNCheck®‡ (K041320), cleared in 2004, and the NeuroMetrix Advance (K070109), cleared in 2008. The NC-stat DPNCheck device measures the sural nerve conduction velocity and sensory nerve action potential amplitude. It is a handheld device with an infrared thermometer, noninvasive electrical stimulation probes, and a single-use biosensor for each test. NC-stat DPNCheck is designed specifically for NCS of the sural nerve in the assessment of

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diabetic peripheral neuropathy. The NeuroMetrix ADVANCE is a POC test that can be used to perform needle EMG in addition to surface electrodes for the performance of NCSs. If the needle EMG module is used, then the device is also intended to measure signals useful in evaluating disorders of muscles.

On January 23, 2017, Cadwell Sierra Summit, Cadwell Sierra Ascent (Cadwell Industries) was cleared for marketing by FDA through the 510K process (K162383). There is a portable laptop version and a desktop application with a handheld device. The system is used for acquisition, display, storage, transmission, analysis, and reporting of electrophysiologic and environmental data including EMG, NCS, evoked potentials, and autonomic responses (RR interval variability). The Cadwell Sierra Summit is used to detect the physiologic function of the nervous system, and to support the diagnosis of neuromuscular diseases or conditions.

FDA product code: JXE.

Other examples of devices cleared for marketing by FDA through the 510(k) process are noted in Table 3.

Table 3. Examples of FDA Cleared Devices for Neural Conduction Testing

Device	Manufacturer	Date Cleared	510(k)	Indications
Axon II™‡	PainDX	1998	K980866	Part of a routine neurologic exam or screening procedure for detection of peripheral neuropathy, which may be caused by various pathologic conditions or exposures to toxic substances
Brevio®‡	Neurotron Medical	2001	K012069	To measure nerve response latency and amplitude in the diagnosis and monitoring of peripheral neuropathies
NC-stat®‡, NC-stat DPN-Check	NeuroMetrix	2004	K041320	To stimulate and measure neuromuscular signals in diagnosing and evaluating systemic and

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				entrapment neuropathies. Added the sural biosensor for use in diagnosing neuropathies affecting the sural nerve.
NC-stat ^{®‡}	NeuroMetrix	2006	K060584	Addition of the modified median motor-sensory biosensor to stimulate and measure neuromuscular signals useful in diagnosing and evaluating systemic and entrapment neuropathies
XLTEK NEUROPATH	Excel Tech	2006	K053058	To stimulate and measure neuromuscular signals useful in diagnosing and evaluating systemic and entrapment neuropathies
NeuroMetrix Advance ^{™‡}	NeuroMetrix	2008	K070109	To measure neuromuscular signals useful as an aid in diagnosing and evaluating individuals suspected of having focal or systemic neuropathies. If the elective needle EMG module is used, then the device is also intended to measure signals useful as an aid in evaluating disorders of muscles.

EMG: electromyography; FDA: U.S. Food and Drug Administration.

Quantitative Sensory Testing

A number of QST devices have been cleared for marketing by the U.S. FDA through the 510(k) process. Examples are listed in Table 4.

Table 4. FDA Approved Quantitative Sensory Testing Devices

Device	Manufacturer	Date Cleared	510(k)	Indications
FDA product code: LLN				

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Neurometer ^{®†}	Neurotron	Jun 1986	K853608	Current perception threshold testing
NK Pressure-Specified Sensory Device, Model PSSD	NK Biotechnical Engineering	Aug 1994	K934368	Pressure-specified sensory testing
AP-4000, Air Pulse Sensory Stimulator	Pentax Precision Instrument	Sep 1997	K964815	Pressure-specified sensory testing
Neural-Scan	Neuro-Diagnostic Assoc.	Dec 1997	K964622	Current perception threshold testing
Vibration Perception Threshold (VPT) METER	Xilas Medical	Dec 2003	K030829	Vibration perception testing
Pain Vision, Model PS-2100	Osachi Co., LTD	Jan 2009	K072882	Current perception threshold testing
FDA product code: NTU				
Contact Heat-Evoked Potential Stimulator (Cheps)	Medoc, Advanced Medical Systems	Feb 2005	K041908	Thermal sensory testing
Modified Contact-Heat Evoked Potential Stimulator (Cheps)	Medoc, Advanced Medical Systems	Jun 2005	K051448	Thermal sensory testing
Pathway - Ats/Cheps	Medoc, Advanced Medical Systems	Jan 2006	K052357	Thermal sensory testing

FDA: U.S. Food and Drug Administration.

Paraspinal Surface Electromyography to Evaluate and Monitor Back Pain

Surface electromyography devices approved by the U.S. Food and Drug Administration (FDA) include those that use a single electrode or a fixed array of multiple surface electrodes. Examples include the CMAP Pro (Medical Technologies) and Model 9200 EMG System (Myotronics-Noromed).

Several FDA approved devices combine SEMG along the spine with other types of monitors. For example, in 2007, the Insight Discovery (Fasstech) was cleared for marketing through the 510(k) process. The device contains 6 sensor types, 1 of which is for SEMG. The indications include

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measuring bilateral differences in SEMG along the spine and measuring SEMG along the spine during functional tasks. (Earlier Insight models had fewer sensors.) FDA product code: IKN.

Rationale/Source

This medical policy was developed through consideration of peer-reviewed medical literature generally recognized by the relevant medical community, U.S. Food and Drug Administration approval status, nationally accepted standards of medical practice and accepted standards of medical practice in this community, technology evaluation centers, reference to federal regulations, other plan medical policies, and accredited national guidelines.

Electromyography and Nerve Conduction Studies

Electromyography and nerve conduction studies, also collectively known as an electrodiagnostic assessment, evaluate the electrical functioning of muscles and peripheral nerves. These tests are diagnostic aids for the evaluation of myopathy and peripheral neuropathy by identifying, localizing, and characterizing electrical abnormalities in the skeletal muscles and peripheral nerves.

Summary of Evidence

For individuals with suspected peripheral neuropathy or myopathy who receive electrodiagnostic assessment including electromyography (EMG) and nerve conduction studies (NCS), the evidence includes small observational studies on a few diagnoses, such as carpal tunnel syndrome, radiculopathy, and myopathy. Relevant outcomes are test accuracy, symptoms, functional outcomes, and quality of life. Because electrodiagnostic assessment is considered the criterion standard for evaluating the electrical function of peripheral nerves and muscles, there is no true alternative reference standard against which the sensitivity and specificity of particular EMG/NCS abnormalities for particular clinical disorders can be calculated. Different studies have used different reference standards, such as EMG/NCS measures of healthy individuals or clinical examination results. In general, these tests are considered more specific than sensitive, and normal results do not rule out the disease. The limited evidence has shown a wide range of sensitivities, which are often less than 50%. The specificity is expected to be considerably higher but the data are insufficient to provide precise estimates of either sensitivity or specificity. The evidence is insufficient to determine that the technology results in an improvement in the health net outcome.

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Automated Point-of-Care Nerve Conduction Tests

Portable devices have been developed to provide POC NCSs. These devices have computational algorithms that can drive stimulus delivery, measure and analyze the response, and provide a report of study results. Automated nerve conduction could be used in various settings, including primary care, without the need for specialized training or equipment.

For individuals who have entrapment carpal tunnel syndrome who received automated POC NCSs, the evidence includes studies on the technical accuracy, diagnostic accuracy, and clinical outcomes from industry-sponsored trials, nonrandomized trials, and registry data. Relevant outcomes are test accuracy and validity, symptoms, and functional outcomes. Four RCTs have reported on the diagnostic accuracy of automated POC nerve conduction testing to diagnose carpal tunnel syndrome. Sensitivity testing has suggested there could be diagnostic value in detecting carpal tunnel syndrome; specificity testing was inconsistent across trials. No reference ranges were validated, and normative values were not defined in these studies. No validation testing by trained medical assistants vs trained specialist was reported in the studies. The evidence on clinical outcomes was limited to a single nonrandomized clinical trial and Neuro Metrix registry data. Neither reported health outcomes assessing patient symptoms or changes in functional status. The evidence is insufficient to determine the effects of the technology on health outcomes.

For individuals with lumbosacral radiculopathy who received automated POC NCSs, the evidence includes industry-sponsored trials and a nonrandomized study of technical accuracy and diagnostic accuracy. Relevant outcomes are test accuracy and validity, symptoms, and functional outcomes. The evidence on the technical and diagnostic accuracy of POC NCS in this population has shown variable test results across reported trials. No normative values were defined. Weaknesses of the studies included lack of applicable or valid reference ranges for testing, and variable test results validating or confirming pathology. The results of the 2 studies on diagnostic performance were inconclusive, with high false-positive results in a single trial. No trials on health outcomes assessing patient symptoms or changes in functional status were identified. The evidence is insufficient to determine the effects of the technology on health outcomes.

For individuals with diabetic peripheral neuropathy who received automated POC NCSs, the evidence includes industry-sponsored observational trials and nonrandomized studies on the technical accuracy and diagnostic accuracy. Relevant outcomes are test accuracy and validity, symptoms, and functional outcomes. The evidence on the technical accuracy for POC NCS in this

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population has shown variable test results across reported trials. No normative values were defined. Weaknesses of the studies included lack of applicable or valid reference ranges for testing to validate or confirm pathology. Of 3 studies reporting evidence on diagnostic accuracy, two used NC-stat DPN-Check. Sensitivity testing has suggested there could be diagnostic value in detecting diabetic peripheral neuropathy in symptomatic individuals; the evidence to detect individuals who are suspected of disease but who have mild symptoms was inconsistent. No reference ranges were validated, and normative values were not defined in 2 of the 3 studies. No validation testing by trained medical assistants vs trained specialist was reported in the studies. No trials on health outcomes assessing patient symptoms or changes in functional status were identified. The evidence is insufficient to determine the effects of the technology on health outcomes.

Quantitative Sensory Testing

Quantitative sensory testing (QST) systems are used for the noninvasive assessment and quantification of sensory nerve function in individuals with symptoms of, or the potential for neurologic damage or disease. Types of sensory testing include current perception threshold testing, pressure-specified sensory testing, vibration perception testing (VPT), and thermal sensory testing. Information on sensory deficits identified using QST has been used in research settings to understand neuropathic pain better. It could be used to diagnose conditions linked to nerve damage and disease, and to improve patient outcomes by impacting management strategies.

Summary of Evidence

For individuals who have conditions linked to nerve damage or disease (eg, diabetic neuropathy, carpal tunnel syndrome) who receive current perception threshold testing, the evidence includes several studies on technical performance and diagnostic accuracy. Relevant outcomes are test accuracy and validity, symptoms, and functional outcomes. The existing evidence does not support the accuracy of current perception threshold testing for diagnosing any condition linked to nerve damage or disease. Studies comparing current perception threshold testing with other testing methods have not reported on sensitivity or specificity. Also, there is a lack of direct evidence on the clinical utility of current perception testing and, because there is insufficient evidence on test performance, an indirect chain of evidence on clinical utility cannot be constructed. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who have conditions linked to nerve damage or disease (eg, diabetic neuropathy, carpal tunnel syndrome) who receive pressure-specified sensory testing, the evidence includes

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several studies on diagnostic accuracy. Relevant outcomes are test accuracy and validity, symptoms, and functional outcomes. Current evidence does not support the diagnostic accuracy of pressure-specified sensory testing for diagnosing any condition linked to nerve damage or disease. A systematic review found that pressure-specified sensory testing had low accuracy for diagnosing spinal conditions. Also, there is a lack of direct evidence on the clinical utility of pressure-specified sensory testing and, because there is insufficient evidence on test performance, an indirect chain of evidence on clinical utility cannot be constructed. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who have conditions linked to nerve damage or disease (eg, diabetic neuropathy, carpal tunnel syndrome) who receive vibration perception testing (VPT), the evidence includes several studies on diagnostic accuracy. Relevant outcomes are test accuracy and validity, symptoms, and functional outcomes. A few studies have assessed the diagnostic performance of vibration testing using devices not cleared by the U.S. Food and Drug Administration (FDA). Also, there is a lack of direct evidence on the clinical utility of VPT and, in the absence of sufficient evidence on test performance, an indirect chain of evidence on clinical utility cannot be constructed. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who have conditions linked to nerve damage or disease (eg, diabetic neuropathy, carpal tunnel syndrome) who receive thermal sensory testing, the evidence includes diagnostic accuracy studies. Relevant outcomes are test accuracy and validity, symptoms, and functional outcomes. Two studies identified evaluated the diagnostic accuracy of thermal quantitative sensory testing (QST) using the same FDA-cleared device. Neither found a high diagnostic accuracy for thermal QST but both studies found the test had potential when used with other tests. An additional study using a different device also supports the potential of thermal QST in combination with other tests. The optimal combination of tests is currently unclear. Also, there is a lack of direct evidence on the clinical utility of thermal sensory testing and, because there is insufficient evidence on test performance, an indirect chain of evidence on clinical utility cannot be constructed. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

Paraspinal Surface Electromyography (SEMG) to Evaluate and Monitor Back Pain

A noninvasive procedure that records the summation of muscle electrical activity, paraspinal surface electromyography (SEMG) has been investigated as a technique to evaluate the physiologic functioning of the back. Additionally, this procedure has been studied as a technique to evaluate

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abnormal patterns of electrical activity in the paraspinal muscles in patients with back pain symptoms, such as spasm, tenderness, limited range of motion, or postural disorders.

Summary of Evidence

For individuals who have back pain who receive paraspinal surface electromyography (SEMG) for evaluation and monitoring, the evidence includes several nonrandomized studies on using findings to classify back pain. Relevant outcomes are test accuracy and validity, symptoms, functional outcomes, quality of life, and resource utilization. There have been no studies directly comparing SEMG with other noninvasive techniques for evaluating back pain, and standard criteria for normal and abnormal SEMG measurements have not been determined. Surface electromyography has been proposed as a noninvasive technique providing objective measurements that would inform treatment decisions in patients with back pain. While studies have shown that SEMG results have detected different pathologies in patients with back pain, none of the studies reported health outcomes. There are also no data on the impact of SEMG for managing back pain. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

Supplemental Information

Electromyography and Nerve Conduction Studies

Practice Guidelines and Position Statements

Guidelines or position statements will be considered for inclusion in 'Supplemental Information' if they were issued by, or jointly by, a US professional society, an international society with US representation, or National Institute for Health and Care Excellence (NICE). Priority will be given to guidelines that are informed by a systematic review, include strength of evidence ratings, and include a description of management of conflict of interest.

American Association of Neuromuscular & Electrodiagnostic Medicine

The American Association of Neuromuscular & Electrodiagnostic Medicine (AANEM) has published several position statements and recommended coverage policies for electromyography (EMG) and nerve conduction studies (NCS).

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The first iteration of the recommended policy for electrodiagnostic medicine was initially published in 1997. Since then, there have been several updates, most recently in 2023. This specific position statement provides detailed information on appropriate coding and billing (see Policy Guidelines).

They also regularly update their model policy for EMG and NCS (most recently updated in 2022), which outlines AANEM's key positions and recommendations. Needle EMG and NCS testing is recommended for the following indications:

1. "Focal neuropathies, entrapment neuropathies, or compressive lesions/syndromes such as carpal tunnel syndrome, ulnar neuropathies, or root lesions, for localization.
2. Traumatic nerve lesions, for diagnosis and prognosis.
3. Generalized neuropathies, such as metabolic (ie diabetic, uremic, etc), toxic, hereditary, or immune-mediated.
4. Neuromuscular junction disorders such as myasthenia gravis, myasthenic syndrome, or botulism.
5. Symptom-based presentations such as 'pain in limb', weakness, cramping/twitching, disturbance of skin sensation or 'paresthesia' when appropriate pre-test evaluations are inconclusive and the clinical assessment unequivocally supports the need for the study.
6. Radiculopathy-cervical, thoracic, lumbosacral.
7. Plexopathy - including idiopathic, traumatic, inflammatory or infiltrative, radiation-induced.
8. Myopathy - including inflammatory myopathies like polymyositis and dermatomyositis, myotonic disorders, and congenital myopathies.
9. Precise muscle location for injections such as botulinum toxin, phenol, etc.

This document also listed situations where electrodiagnostic assessment is considered investigational.

In 2005, the AANEM published practice parameters on the utility of EMG/NCS for the diagnosis of peroneal neuropathy. This evidence-based review focused on whether EMG/NCS are useful in diagnosing peroneal neuropathy and/or in determining prognosis. Table 5 lists recommendations AANEM deemed "possibly useful, to make or confirm" a diagnosis. This guideline was most recently reaffirmed in October 2020.

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Table 5. Guidelines on Diagnosis of Peroneal Neuropathy

Recommendation	LOR	COE
Motor NCSs of the peroneal nerve recording from the AT and EDB muscles	C	III
Orthodromic and antidromic superficial peroneal sensory NCS	C	III
At least 1 additional normal motor and sensory NCS in the same limb, to assure that the peroneal neuropathy is isolated, and not part of a more widespread local or systemic neuropathy		
Data are insufficient to determine the role of needle EMG in making the diagnosis of peroneal neuropathy. However, abnormalities on needle examination outside of the distribution of the peroneal nerve should suggest alternative diagnoses	U	IV Expert
In patients with confirmed peroneal neuropathy, EDX studies are possibly useful in providing prognostic information, with regards to recovery of function	C	III/IV

AT: anterior tibialis; COE: class of evidence; EDB: extensor digitorum brevis; EDX: electrodiagnostic; EMG: electromyography; LOR: level of recommendation; NCS: nerve conduction studies.

A 2003 consensus statement on diagnosing multifocal motor neuropathy from AANEM has stated: "Multifocal motor neuropathy is a diagnosis that is based on recognition of a characteristic pattern of clinical symptoms, clinical signs, and electrodiagnostic findings. The fundamental electrodiagnostic finding is partial conduction block of motor axons."

In 2018, the AANEM published a policy statement on the use of EMG for distal symmetric polyneuropathy. The statement described 5 situations in which EMG would be beneficial for patients with distal symmetric polyneuropathy: "1) determining primary and alternative diagnoses; 2) determining severity, duration, and prognosis of disease; 3) evaluating risk of associated problems; 4) determining the effect of medications; and 5) evaluating the effect of toxic exposures."

In 2020, the AANEM issued a consensus statement on the utility and practice of electrodiagnostic (EDX) testing in the pediatric population. The following conclusions were made:

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- "...certain categories of inherited diseases such as muscular dystrophy and SMA [spinal muscular atrophy] do not routinely require EMG as part of the diagnostic evaluation. However, in atypical cases EDX testing can provide critical assistance with narrowing of the differential diagnosis."
- "...techniques and practice for this important diagnostic test modality will continue to evolve in the future."
- "EDX testing in children will continue to complement other diagnostic test modalities such as serum tests, muscle biopsy, imaging, and genetic testing."

American Academy of Orthopaedic Surgeons

In 2016, the American Academy of Orthopaedic Surgeons (AAOS) published updated guidelines on the management of carpal tunnel syndrome. Table 6 lists relevant recommendations to this policy.

Table 6. Guidelines on Management of Carpal Tunnel Syndrome

Recommendation	Strength of Recommendation
"Limited evidence supports that a hand-held nerve conduction study (NCS) device might be used for the diagnostic of carpal tunnel syndrome."	Limited ^a
"Moderate evidence supports that diagnostic questionnaires and/or electrodiagnostic studies could be used to aid the diagnosis of carpal tunnel syndrome."	Moderate ^b

^aEvidence from 2 or more "Low" strength studies with consistent findings or evidence from a single study for recommending for or against the intervention or diagnostic test or the evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.

^bEvidence from 2 or more "moderate" quality studies with consistent findings, or evidence from a single "high" quality study for recommending for or against the intervention.

American Academy of Neurology

In 2004, the American Academy of Neurology (AAN) approved a position statement, endorsed by the AANEM and the American Academy of Physical Medicine & Rehabilitation, on diagnostic electromyography that included the following:

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- "Clinical needle electromyography (EMG) is an invasive medical procedure during which the physician inserts an electrode into a patient's muscles to diagnose the cause of muscle weakness. Needle EMG allows physicians to distinguish a wide range of conditions, from carpal tunnel syndrome to ALS (Lou Gehrig disease).
- Needle EMG is also an integral component of the neurological examination that cannot be separated from the physician's evaluation of the patient. The test is dynamic and depends upon the visual, tactile, and audio observations of the examiner. There is no way for physicians to independently verify the accuracy of reports performed by non-physicians.
- Misdiagnosis can mean delayed or inappropriate treatment (including surgery) and diminished quality of life. Because needle EMG is strictly diagnostic, the procedure clearly and exclusively falls within the practice of medicine."

North American Spine Society

In 2012, the North American Spine Society (NASS) published guidelines on the diagnosis and treatment of lumbar disc herniation. This document made the following statement about the use of EMG/NCS for diagnosis of lumbar disc herniation: "Electromyography, nerve conduction studies and F-waves are suggested to have limited utility in the diagnosis of lumbar disc herniation with radiculopathy. H-reflexes can be helpful in the diagnosis of an S1 radiculopathy, though are not specific to the diagnosis of lumbar disc herniation. (Grade of Recommendation: B)"

While no updates to this guideline are currently scheduled to be published, all future publications of the NASS guidelines will not be freely available.

U.S. Preventive Services Task Force Recommendations

Not applicable.

Medicare National Coverage

Sensory nerve conduction threshold tests are distinct from "assessment of nerve conduction velocity, amplitude and latency" and from "short-latency somatosensory evoked potentials."

In 2004, the Centers for Medicare & Medicaid affirmed its 2002 noncoverage policy, concluding: "that the use of any type of sNCT [sensory nerve conduction threshold test] device (e.g., 'current output' type device used to perform current perception threshold [CPT], pain perception threshold [PPT], or pain tolerance threshold [PTT] testing or 'voltage input' type device used for voltage-nerve

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conduction threshold [v-NCT] testing) to diagnose sensory neuropathies or radiculopathies in Medicare beneficiaries is not reasonable and necessary."

Ongoing and Unpublished Clinical Trials

A search of [ClinicalTrials.gov](https://clinicaltrials.gov) in April 2024 did not identify any ongoing or unpublished trials that would likely influence this review.

Automated Point-of-Care Nerve Conduction Tests Practice Guidelines and Position Statements

American Association of Neuromuscular & Electrodiagnostic Medicine

The American Association of Neuromuscular & Electrodiagnostic Medicine (AANEM) issued a position statement (2006) that illustrated how standardized nerve conduction studies (NCSs) performed independently of needle electromyography studies may miss data essential for an accurate diagnosis. AANEM discussed how nerve disorders are far more likely to be misdiagnosed or missed completely if a practitioner without the proper skill and training is interpreting the data, making a diagnosis, and establishing a treatment plan. The Association stated that, "the standard of care in clinical practice dictates that using a predetermined or standardized battery of NCSs for all individuals is inappropriate," and concluded that, "It is the position of the AANEM that, except in unique situations, NCSs and needle EMG should be performed together in a study design determined by a trained neuromuscular physician." This position statement was reviewed, updated, and approved by AANEM in 2014. No changes were made to the earlier statement on NCSs.

American Academy of Orthopaedic Surgeons

The American Academy of Orthopaedic Surgeons (2016) released guidelines on the management of carpal tunnel syndrome. The guidelines were endorsed by other specialty societies including the American College of Radiology and American College of Surgeons. The guidelines found "limited evidence" for a "hand-held nerve conduction study."

U.S. Preventive Services Task Force Recommendations

Not applicable.

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Medicare National Coverage

There is no national coverage determination. In the absence of a national coverage determination, coverage decisions are left to the discretion of local Medicare carriers.

Ongoing and Unpublished Clinical Trials

A search of [ClinicalTrials.gov](https://clinicaltrials.gov) in July 2020 did not identify any ongoing or unpublished trials that would likely influence this review.

Quantitative Sensory Testing

Clinical Input From Physician Specialty Societies and Academic Medical Centers

While the various physician specialty societies and academic medical centers may collaborate with and make recommendations during this process, through the provision of appropriate reviewers, input received does not represent an endorsement or position statement by the physician specialty societies or academic medical centers, unless otherwise noted.

In response to the requests from physician specialty societies and academic medical centers, input was received from 1 specialty society and 1 academic medical center while the policy was under review in 2008. Input from both sources agreed with the policy statement that quantitative sensory testing is considered investigational.

Practice Guidelines and Position Statements

Guidelines or position statements will be considered for inclusion in 'Supplemental Information' if they were issued by, or jointly by, a US professional society, an international society with US representation, or National Institute for Health and Care Excellence (NICE). Priority will be given to guidelines that are informed by a systematic review, include strength of evidence ratings, and include a description of management of conflict of interest.

American Academy of Neurology

The American Academy of Neurology (2003; reaffirmed 2022) concluded that quantitative sensory testing (QST) is probably (level B recommendation) an effective tool for documenting of sensory abnormalities and changes in sensory thresholds in longitudinal evaluation of patients with diabetic neuropathy. [Shy ME, Frohman EM, So YT, et al. *Quantitative sen....* 60(6): 898-904. PMID [quantitative](https://pubmed.ncbi.nlm.nih.gov/12111111/)] Evidence was weak or insufficient to support the use of QST in patients with other

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conditions (small fiber sensory neuropathy, pain syndromes, toxic neuropathies, uremic neuropathy, acquired and inherited demyelinating neuropathies, or malingering).

American Association of Neuromuscular & Electrodiagnostic Medicine

In 2004, the American Association of Neuromuscular & Electrodiagnostic Medicine (AANEM) published a technology literature review on QST (light touch, vibration, thermal, pain). The review concluded that QST is a reliable psychophysical test of large- and small-fiber sensory modalities but is highly dependent on the full patient cooperation. Abnormalities do not localize dysfunction to the central or peripheral nervous system, and no algorithm can reliably distinguish between psychogenic and organic abnormalities. The AANEM review also indicated that QST had been shown to be reasonably reproducible over a period of days or weeks in normal subjects, but, for individual patients, more studies are needed to determine the maximum allowable difference between 2 quantitative sensory tests that can be attributed to experimental error.

In 2005, the AANEM with the American Academy of Neurology and American Academy of Physical Medicine & Rehabilitation developed a formal case definition of distal symmetrical polyneuropathy based on a systematic analysis of peer-reviewed literature supplemented by consensus from an expert panel. QST was not included as part of the final case definition, given that the reproducibility of QST ranged from poor to excellent, and the sensitivities and specificities of QST varied widely among studies.

American Diabetes Association

The American Diabetes Association annually updates its standards for retinopathy, neuropathy, and foot care. Although temperature and vibration testing are recommended as part of the evaluation of small fiber and large fiber function, respectively, the specific screening tests for diabetic peripheral neuropathy that are described in the standard are manual/clinical rather than quantitative. Therefore, QST does not appear to have a role in the current routine evaluation or diagnosis of diabetic peripheral neuropathy.

U.S. Preventive Services Task Force Recommendations

Not applicable.

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Medicare National Coverage

In 2002, Medicare announced a national noncoverage policy on sensory nerve conduction threshold testing. Medicare reconsidered its policy, but affirmed it, concluding that any use of sensory nerve conduction threshold testing to diagnose sensory neuropathies or radiculopathies is not reasonable and necessary. This decision was reaffirmed in 2004. Medicare has not addressed coverage for other types of QST.

Ongoing and Unpublished Clinical Trials

Some currently ongoing and unpublished trials that might influence this review are listed in Table 7.

Table 7. Summary of Key Trials

NCT No.	Trial Name	Planned Enrollment	Completion Date
<i>Ongoing</i>			
NCT04393363	Early Detection of Neuropathy and Cognitive Impairment Following Treatment for Haematological Malignancies (NOVIT1)	20	Dec 2030
NCT05546138	Characterization and Prediction of Early Onset Diabetic Peripheral Neuropathy (NeuroPredict)	200	Dec 2029
NCT05959954	Quantitative Sensory Testing to Predict Progression to Nociceptive Pain in Carpal Tunnel Syndrome: A Prospective Cohort Study	120	Nov 2024
<i>Unpublished</i>			
NCT03909464	Exploration Of The Sensitivity And Specificity Of The Pressure-Specified Sensory Device™ (PSSD) For Chemotherapy-Induced Peripheral Neuropathy	26	Nov 2019

NCT: national clinical trial.

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Paraspinal Surface Electromyography to Evaluate and Monitor Back Pain Practice Guidelines and Position Statements

Guidelines or position statements will be considered for inclusion in 'Supplemental Information' if they were issued by, or jointly by, a US professional society, an international society with US representation, or National Institute for Health and Care Excellence (NICE). Priority will be given to guidelines that are informed by a systematic review, include strength of evidence ratings, and include a description of management of conflict of interest.

American College of Occupational and Environmental Medicine

In 2019, the guideline from the American College of Occupational and Environmental Medicine on diagnostic tests for low back disorders does not recommend surface electromyography as a technique for diagnosing low back disorders, based on insufficient evidence of efficacy.

North American Spine Society and American Academy of Pain Medicine

In 2020, the North American Spine Society with input from the American Academy of Pain Medicine issued a guideline on the diagnosis and treatment of low back pain. When discussing the diagnostic accuracy of nonimaging tests, the guideline lacks any statement on surface electromyography.

U.S. Preventive Services Task Force Recommendations

Not applicable.

Medicare National Coverage

There is no national coverage determination. In the absence of a national coverage determination, coverage decisions are left to the discretion of local Medicare carriers.

Ongoing and Unpublished Clinical Trials

A search of ClinicalTrials.gov in April 2024 did not identify any ongoing or unpublished trials that would likely influence this review.

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Policy History

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- 01/04/2006 Medical Director review
- 01/17/2006 Medical Policy Committee review. Clarification of provider qualifications.
- 01/26/2006 Quality Care Advisory Council approval.
- 01/10/2007 Medical Director review
- 01/17/2007 Medical Policy Committee approval. NEMG without nerve conduction studies and nerve conduction without EMG are considered to be investigational was deleted. Not medically necessary statements added.
- 01/09/2008 Medical Director review
- 01/23/2008 Medical Policy Committee approval
- 01/07/2009 Medical Director review
- 01/14/2009 Medical Policy Committee approval. No change to coverage eligibility.
- 01/07/2010 Medical Policy Committee approval
- 01/20/2010 Medical Policy Implementation Committee approval. Coverage eligibility unchanged.
- 01/06/2011 Medical Policy Committee review
- 01/19/2011 Medical Policy Implementation Committee approval. Coverage eligibility unchanged.
- 03/01/2012 Medical Policy Committee review
- 03/21/2012 Medical Policy Implementation Committee approval. Coverage eligibility unchanged.
- 01/23/2013 Coding updated
- 03/07/2013 Medical Policy Committee review

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- 03/20/2013 Medical Policy Implementation Committee approval. Added “Based on review of available data, the Company considers automated nerve conduction tests to be investigational.*”
 “Based on review of available data, the Company considers office-based automated nerve conduction studies which are remotely interpreted such as NC-stat[®] (NEUROMetrix[®] Inc.)[‡] to be investigational” was removed from policy.
- 03/06/2014 Medical Policy Committee review
- 03/19/2014 Medical Policy Implementation Committee approval. No change to coverage.
- 04/02/2015 Medical Policy Committee review
- 04/20/2015 Medical Policy Implementation Committee approval. No change to coverage.
- 08/03/2015 Coding update: ICD10 Diagnosis code section added; ICD9 Procedure code section removed.
- 04/07/2016 Medical Policy Committee review
- 04/20/2016 Medical Policy Implementation Committee approval. Investigational statement for NEMG or NCS for treatment of any diagnosis other than those listed in coverage statement.
- 01/01/2017 Coding update: Removing ICD-9 Diagnosis Codes
- 04/06/2017 Medical Policy Committee review
- 04/19/2017 Medical Policy Implementation Committee approval. No change to coverage.
- 07/05/2018 Medical Policy Committee review
- 07/11/2018 Medical Policy Implementation Committee approval. No change to coverage.
- 07/03/2019 Medical Policy Committee review
- 07/18/2019 Medical Policy Implementation Committee approval. No change to coverage.
- 07/02/2020 Medical Policy Committee review
- 07/08/2020 Medical Policy Implementation Committee approval. No change to coverage.
- 07/01/2021 Medical Policy Committee review
- 07/14/2021 Medical Policy Implementation Committee approval. No change to coverage.
- 09/01/2022 Medical Policy Committee review
- 09/14/2022 Medical Policy Implementation Committee approval. Added compressive neuropathies under eligible criteria for Electromyography and Nerve Conduction Studies.
- 06/21/2023 Coding update
- 09/07/2023 Medical Policy Committee review
- 09/13/2023 Medical Policy Implementation Committee approval. No change to coverage.

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09/05/2024 Medical Policy Committee review

09/11/2024 Medical Policy Implementation Committee approval. No change to coverage.

Next Scheduled Review Date: 09/2025

Coding

The five character codes included in the Blue Cross Blue Shield of Louisiana Medical Policy Coverage Guidelines are obtained from Current Procedural Terminology (CPT®)‡, copyright 2023 by the American Medical Association (AMA). CPT is developed by the AMA as a listing of descriptive terms and five character identifying codes and modifiers for reporting medical services and procedures performed by physician.

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Codes used to identify services associated with this policy may include (but may not be limited to) the following:

Code Type	Code
CPT	0106T, 0107T, 0108T, 0109T, 0110T, 95860, 95861, 95863, 95864, 95865, 95866, 95867, 95868, 95869, 95870, 95872, 95875, 95885, 95886, 95887, 95905, 95907, 95908, 95909, 95910, 95911, 95912, 95913, 95937, 95999
HCPCS	G0255, S3900
ICD-10 Diagnosis	All related diagnoses

*Investigational – A medical treatment, procedure, drug, device, or biological product is Investigational if the effectiveness has not been clearly tested and it has not been incorporated into standard medical practice. Any determination we make that a medical treatment, procedure, drug, device, or biological product is Investigational will be based on a consideration of the following:

- A. Whether the medical treatment, procedure, drug, device, or biological product can be lawfully marketed without approval of the U.S. Food and Drug Administration (FDA) and whether such approval has been granted at the time the medical treatment, procedure, drug, device, or biological product is sought to be furnished; or
- B. Whether the medical treatment, procedure, drug, device, or biological product requires further studies or clinical trials to determine its maximum tolerated dose, toxicity, safety, effectiveness, or effectiveness as compared with the standard means of treatment or diagnosis, must improve health outcomes, according to the consensus of opinion among experts as shown by reliable evidence, including:
 - 1. Consultation with technology evaluation center(s);
 - 2. Credible scientific evidence published in peer-reviewed medical literature generally recognized by the relevant medical community; or
 - 3. Reference to federal regulations.

**Medically Necessary (or “Medical Necessity”) - Health care services, treatment, procedures, equipment, drugs, devices, items or supplies that a Provider, exercising prudent clinical judgment, would provide to a patient for the purpose of preventing, evaluating, diagnosing or treating an illness, injury, disease or its symptoms, and that are:

- A. In accordance with nationally accepted standards of medical practice;

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- B. Clinically appropriate, in terms of type, frequency, extent, level of care, site and duration, and considered effective for the patient's illness, injury or disease; and
- C. Not primarily for the personal comfort or convenience of the patient, physician or other health care provider, and not more costly than an alternative service or sequence of services at least as likely to produce equivalent therapeutic or diagnostic results as to the diagnosis or treatment of that patient's illness, injury or disease.

For these purposes, "nationally accepted standards of medical practice" means standards that are based on credible scientific evidence published in peer-reviewed medical literature generally recognized by the relevant medical community, Physician Specialty Society recommendations and the views of Physicians practicing in relevant clinical areas and any other relevant factors.

‡ Indicated trademarks are the registered trademarks of their respective owners.

NOTICE: If the Patient's health insurance contract contains language that differs from the BCBSLA Medical Policy definition noted above, the definition in the health insurance contract will be relied upon for specific coverage determinations.

NOTICE: Medical Policies are scientific based opinions, provided solely for coverage and informational purposes. Medical Policies should not be construed to suggest that the Company recommends, advocates, requires, encourages, or discourages any particular treatment, procedure, or service, or any particular course of treatment, procedure, or service.

NOTICE: Federal and State law, as well as contract language, including definitions and specific contract provisions/exclusions, take precedence over Medical Policy and must be considered first in determining eligibility for coverage.

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