Clinical Policy Title: Actigraphy

Clinical Policy Number: 10.01.02

Effective Date: April 1, 2017
Initial Review Date: November 16, 2016
Most Recent Review Date: November 16, 2016
Next Review Date: November 2017

Related policies:
CPh 07.07.05 Diagnosing obstructive sleep apnea in adults

ABOUT THIS POLICY: AmeriHealth Caritas Iowa has developed clinical policies to assist with making coverage determinations. AmeriHealth Caritas Iowa’s clinical policies are based on guidelines from established industry sources, such as the Centers for Medicare & Medicaid Services (CMS), state regulatory agencies, the American Medical Association (AMA), medical specialty professional societies, and peer-reviewed professional literature. These clinical policies along with other sources, such as plan benefits and state and federal laws and regulatory requirements, including any state- or plan-specific definition of “medically necessary,” and the specific facts of the particular situation are considered by AmeriHealth Caritas Iowa when making coverage determinations. In the event of conflict between this clinical policy and plan benefits and/or state or federal laws and/or regulatory requirements, the plan benefits and/or state and federal laws and/or regulatory requirements shall control. AmeriHealth Caritas Iowa’s clinical policies are for informational purposes only and not intended as medical advice or to direct treatment. Physicians and other health care providers are solely responsible for the treatment decisions for their patients. AmeriHealth Caritas Iowa’s clinical policies are reflective of evidence-based medicine at the time of review. As medical science evolves, AmeriHealth Caritas Iowa will update its clinical policies as necessary. AmeriHealth Caritas Iowa’s clinical policies are not guarantees of payment.

Coverage policy

AmeriHealth Caritas Iowa considers actigraphy to be experimental and investigational, and therefore not medically necessary.

Limitations:

None.

Alternative covered services:

Polysomnography.

Background

Actigraphy is a method of continually measuring human rest and activity cycles (unit movements)
through an actimetry sensor. The technique first began in the 1960s. The three main types of this device are sleep actigraphs, activity actigraphs, and movement actigraphs.

Since the 1990s, the predominant purpose for the device is sleep behavior. Sleep actigraphs, worn on the non-dominant arm like a wristwatch often (consecutively) for a week or more, are used for disorders like insomnia, circadian rhythm sleep disorders, sleepiness, and restless leg syndrome. Unlike polysomnography (PSG), actigraphs permit movement by the patient while data is recorded. Information can be later transmitted to a computer, or can be analyzed in real time. These devices are used around the clock for days at a time.

Actigraphy is also used to measure activity behavior. Activity actigraphs are worn like a pedometer around the waist. They are used for several days and evaluate activities while awake, plus calories burned. Activity actigraphs are preferable for measuring and assessing activities during waking hours rather than sleep.

A third type of actigraphy is used to measure human movement. Movement actigraphs are larger than sleep or activity actigraphs, and are worn on the dominant shoulder. These actigraphs are three dimensional (the others are one-dimensional), and are used only for several hours at a time.

The actigraph unit has an accelerometer, a low-pass filter, which filters out all but the 2-3 Hz band to ignore external vibrations; a timer for starting and stopping, a memory to store data, and an interface to program the timer and download data.

**Searches**

AmeriHealth Caritas Iowa searched PubMed and the databases of:

- UK National Health Services Centre for Reviews and Dissemination.
- Agency for Healthcare Research and Quality’s National Guideline Clearinghouse and other evidence-based practice centers.
- The Centers for Medicare & Medicaid Services (CMS).

We conducted searches on September 28, 2016. Search term was: “Actigraph.”

We included:

- **Systematic reviews**, which pool results from multiple studies to achieve larger sample sizes and greater precision of effect estimation than in smaller primary studies. Systematic reviews use predetermined transparent methods to minimize bias, effectively treating the review as a scientific endeavor, and are thus rated highest in evidence-grading hierarchies.
- **Guidelines based on systematic reviews**.
- **Economic analyses**, such as cost-effectiveness, and benefit or utility studies (but not simple cost studies), reporting both costs and outcomes — sometimes referred to as efficiency
studies — which also rank near the top of evidence hierarchies.

**Findings**

As actigraphy became more commonly used in diagnosing sleep disorders, numerous clinical guidelines governing its use have been produced. The American Sleep Disorders Association (ASDA) did not endorse the service in the routine assessment of sleep disorders, but as a potential adjunct in some cases (Thorpy, 1995). Subsequently, ASDA questioned actigraphy’s ability to evaluate insomnia complaints (Chesson, 2000), and ability to accurately diagnose sleep disorders in general (Littner, 2003). In 2007, the American Academy of Sleep Medicine published a guideline stating that actigraphy is indicated for evaluation of patients with advanced sleep phase syndrome, delayed sleep phase syndrome, and shift work disorder. The panel added that “some evidence” existed for actigraphy’s ability to evaluate other conditions, such as jet lag disorder and non-24 hr. sleep/wake syndrome (Morgenthaler, 2007).

Early studies tended to agree that actigraphy was not as accurate in determining sleep measurements as PSG, but was more reliable than sleep logs that rely on patients recalling how often and for how long they remained awake during the night (Ancoli-Israel, 2003). A review by Hayes concluded that there is very little evidence to evaluate the accuracy of actigraphy in circadian rhythms for sleep disorders, even though it is more convenient than PSG (Hayes, 2014). Sensitivity and specificity of actigraphy compared with PSG for understanding sleep patterns in obstructive sleep apnea have been estimated at just over 85% (Hayes, 2008).

A 2015 meta-analysis of nine (9) studies compared 412 persons with or without bipolar disorders. Actigraphy was found to detect significant differences between the two groups in sleep latency, sleep duration, wake after sleep onset, and sleep efficiency. Differences were greatest when age differences between cases and controls were larger, indicating that future actigraphy studies should better match groups by age (Geoffroy, 2015).

Another meta-analysis/systematic review of sleep-wake disturbance in patients with bipolar disorder and patients at high risk for the disease included an assessment of actigraphy as one means of diagnosis. Actigraphy found higher averages for bipolar patients vs. controls for total sleep time, sleep onset latency, time in bed, and wake after sleep onset. Compared with adults with insomnia, bipolar patients had longer total sleep time and lower activity counts, based on activity results. Persons at risk for bipolar disorder vs. healthy controls had lower relative amplitude of the sleep-wake cycle and lower variability in sleep efficiency. The authors suggest that future actigraphy studies should report what actigraphs are used, along with standardizing algorithms to produce better compare between studies when different actigraphs are used (Ng, 2015).

Another meta-analysis (8 articles, n=393) used actigraphy as a means of measuring total sleep time and daytime activity in childhood Attention Deficit Hyperactivity Disorder (ADHD) patients who did or did not receive methylphenidate, finding that the drug reduced mean activity time in ADHD children but
also negatively affected total sleep time (DeCrescenzo, 2014). Members of the same research group later declared actigraphy to be an effective tool in monitoring sleep and activity in ADHD (DeCrescenzo, 2016).

Actigraphy has been used to measure sleep disturbances for patients with specific disorders. Systematic reviews have focused on actigraphy to understand sleep patterns in breast cancer patients undergoing chemotherapy (Madsen, 2015), patients with Alzheimer’s disease (Camargos, 2013), depression (Burton, 2013), and post-surgical patients (Madsen, 2013).

Leg actigraphy to analyze periodic limb movements of sleep was a topic of a meta-analysis of 14 studies. The study concluded that PSG is the most effective means of understanding these abnormalities. While actigraphy shows promise, results are difficult to compare between studies, since they vary in sensitivity and specificity to detect the disorder (often due to the multiple actigraphy models); and comparing actigraph data placed on both legs also can be inaccurate (Plante, 2014).

Some articles have compared the accuracy and reliability of actigraphy with other methods of measuring sleep activity. One systemic review that studied residents of aged care facilities concluded that wrist actigraphy was the most accurate sleep assessment tool (Koch, 2006).

A large systematic review, based on 32 studies, found that actigraphy can provide accurate and useful data on for post-surgical patients, including total sleep time/sleep efficiency reduction, increase in awakenings, differentiation between delirious and non-delirious patients, ability to determine differential effects based on patient age, and ability to document reduced severity in patients after minor surgery (Madsen, 2013).

Randomized controlled trials (RCTs) have compared actigraphy with other methods of detecting sleep and other human movements. A recent study of 78 children with sleep disorders revealed actigraphy produced comparable results to PSG, and superior to those of a smartphone application accelerometer named MotionX 24/7 (Toon, 2016). A trial involving 11 healthy subjects found actigraphy provided useful assessments of sleep, but was not as effective as PSG in assessing direct activity endpoints (Peterson, 2012).

Policy updates:

None.

Summary of clinical evidence:

<table>
<thead>
<tr>
<th>Citation</th>
<th>Content, Methods, Recommendations</th>
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<tbody>
<tr>
<td>Geoffroy (2015)</td>
<td>Key points:</td>
</tr>
<tr>
<td>Assessment of difference in</td>
<td>• Meta-analysis of 9 studies (n=412).</td>
</tr>
</tbody>
</table>
sleep abnormalities between bipolar patients and controls, using actigraphy

- Found bipolar patients (vs. controls) were significantly different in sleep latency, sleep duration, wake after sleep onset, and sleep efficiency.
- Greater differences when age differences between groups were greatest suggests that future studies better control for age.

Ng (2015)
Comparing sleep-wake disturbances in bipolar and at-risk persons with controls

Key points:
- Meta-analysis of 21 studies, n=531, actigraphy was one of the tests used; and found
  - Longer times for bipolar patients vs. controls for total sleep time, sleep onset latency, time in bed, and wake after sleep onset.
  - Longer sleep time and lower activity counts based on activity results for bipolar patients vs. adults with insomnia.
  - Lower relative amplitude of the sleep-wake cycle and lower variability in sleep efficiency for persons at high risk for bipolar patients vs. controls.

DeCrescenzo (2014)
Using actigraphy to monitor effects of methylphenidate, children w/ Attention Deficit Hyperactivity Disorder

Key points:
- Meta-analysis, 8 articles (n=393), children with ADHD, taking methylphenidate or placebo.
- Cases have lower average activity than controls, lower total sleep time.
- Actigraphy was able to detect the above differences.

Madsen (2013)
Assessment of ability of actigraphy to document sleep changes for postsurgical patients

Key points:
- Systematic review, 32 studies included.
- Actigraphy able to document reduction in total sleep time, reduction in sleep efficiency, increase in awakenings, differentiation between delirious and non-delirious patients, differentiation of detrimental effects based on patient age, reduced severity for minor (vs. major) surgery.

Glossary

Actigraphy — a non-invasive device that monitors rest and activity, often used in sleep disorders.

Circadian rhythm sleep disorders — a group of sleep disorders marked by the failure to fall asleep at the desired time and frequent awakenings.

Polysomnography — a recording of the physical changes that occur during sleep.

References

Professional society guidelines/other:


Peer-reviewed references:


Geoffroy PA, Scott J, Boudebesse C, et al. Sleep in patients with remitted bipolar disorders: a meta-


**CMS National Coverage Determinations (NCDs):**

No NCDs identified as of the writing of this policy.

**Local Coverage Determinations (LCDs):**

No LCDs identified as of the writing of this policy.

**Commonly submitted codes**
Below are the most commonly submitted codes for the service(s)/item(s) subject to this policy. This is not an exhaustive list of codes. Providers are expected to consult the appropriate coding manuals and bill accordingly.

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<td>95803</td>
<td>Actigraphy testing, recording, analysis, interpretation, and report (minimum of 72 hours to 14 consecutive days of recording)</td>
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<table>
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