WHY CALIBRATION MATTERS:

Medical Scales, Accuracy, and Safety

Scales are a necessary piece of equipment for all medical facilities.

A patient's weight provides vital information for detecting fluid retention, calculating proper medication dosages, and screening for malnutrition.

Properly maintaining a patient scale ensures accurate and consistent patient weight readings, which are critical to consistent, effective patient outcomes. Conversely, miscalibrated or inaccurate scales can cause inconsistencies that can lead to improper treatment. This is especially relevant in environments where multiple scales are used with patients, as miscalibrated scales will record results differently than properly calibrated scales.

A study of nearly 8,000 patient scales in 200 hospitals showed more than a third of all scales tested were inaccurate.[1] Another study found that more than 15 percent of tested scales showed an average inaccuracy greater than 6 pounds.[2] In one state alone, 479 medication errors in a single year were attributed to inaccurate patient weights.[3]

The only way to guard against inaccuracies in patient scales is regular inspection and calibration.

Calibration helps ensure that scales are accurate and consistent — essential when using weight to track patient health or determine medication dosing.

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[1] Evans L., C. Best C "Accurate Assessment of Patient Weight." Nursing Times, 2014. 110:12, p 12-14.
[2] Stein, Risa, PhD; C. Keith Haddock, PhD; Walker S.C. Poston, PhD, MPH; Dana Catanese; John A. Spertus, MD. "Precision in Weighting: A Comparison of Scales Found in Physician Offices, Fitness Centers, and Weight Loss Centers." Public Health Reports; May-June 2005, p 266-270.
[3] "Medication Errors: Significance of Accurate Patient Weights." Pennsylvania Patient Safety Advisory, March 2009.

How Scale Accuracy Affects Patient Safety

Inaccurate scales can cause more than frustration. Some medications, particularly for renal disease and some cancers, are dosed by weight. An inaccurate weight can lead to a patient getting too little — or too much — medication, resulting in a non-therapeutic or potentially harmful dose.

Surveying four years of state health event reports, **the Pennsylvania Patient Safety Authority found 479 instances of medication errors resulting from inaccurate weight**. Sixty-seven percent resulted in a patient receiving the wrong dose, with more than one percent of cases causing enough harm to merit additional treatment.[4]

Additionally, when scales are not calibrated across an integrated delivery network (IDN) or even a large medical practice, patients visiting frequently can have markedly different weights reported from weighing-to-weighing. Inaccuracy may mask weight changes that signal health problems or help determine treatment plans. For example, an American Heart Association Journal study showed that a weight gain of 2 pounds or more is associated with increased risk of heart failure hospitalization in certain patient populations.[5]

Such errors can lead to potentially dangerous, expensive complications. Establishing and managing a controlled process to ensure your scales are calibrated accurately and consistently can help better manage risk by reducing the potential for weighing errors, which in turn can improve patient outcomes and safety.

But I only buy professional grade scales. Why would they ever need calibration?

Healthcare providers utilize professional grade scales because of their accuracy and durability. But professional grade scales are still precision measuring instruments and, like many other medical instruments, they require calibration. Professional grade scales use meticulously manufactured mechanical and electronic components to ensure consistent and accurate weighing results. These components are subject to wear caused by both normal usage and abuse. While this wear may be small at first, over time it can lead to significant changes in a scale's accuracy if not checked regularly. Calibration is simply the process of checking to see if any change has occurred and correcting it before the scale's results are impacted.

Is this "normal"?

Consider a more familiar example — the wheel alignment on a new car. We all expect that a new car will have its wheels aligned to factory specifications. We also know that after driving many miles the alignment will need to be checked and, possibly, re-set. This is especially true after new tires are put on, the car is in an accident, or it hits a large pothole. Day-to-day scale use is similar to putting miles on our cars. Additionally, if a scale is forcefully jostled while being moved, is subject to extensive use, or has something dropped on it, the potential for a change increases.

With all the possible things that can affect a scale's accuracy, regular inspection and calibration are vital to ensure reliable readings and consistent, informed treatment decisions.

> *"Professional grade scales are still precision measuring instruments, and require calibration."*

[4] "Medication Errors: Significance of Accurate Patient Weights." Pennsylvania Patient Safety Advisory, March 2009.
[5] "Patterns of Weight Change Preceding Hospitalization for Heart Failure." American Heart Association, Circulation Journal, 2007. http://circ.ahajournals.org/content/116/14/1549

An investigation of scale precision within a variety of settings found scales that had not been calibrated in the previous year were 150 percent more imprecise than scales calibrated in the last year.

Factors related to scale precision

(N=223) based on 250.0 lbs. (113.6 kg) test[6]

Factor	Number	MAWD lbs. (kg)	F-value p-value
Calibration in past year			12.05, <0.001
No	139	9.15 (4.16)[a]	
Yes	47	6.05 (2.75)[b]	
Don't Know	6	5.35 (2.43)	

MAWD = Mean Absolute Weight Difference in pounds and kilograms.

NOTES: The total number of scales for each factor may be less than 223 given missing data or data falling into categories too small to analyze. Significant differences (p<0.05) occurred between superscripts (a and b) within each factor

> *"Of the scales tested, 72% had not been calibrated in the last year. The inaccuracy of these uncalibrated scales was more than 150% greater than that of the group that had been calibrated during the previous year."*

How and when should I calibrate my scales?

The FDA and The Joint Commission do not have specific standards or recommendations regarding calibration of medical scales. To ensure scale accuracy, they do require that facilities and providers engage in a regular and appropriate maintenance program that adheres to the manufacturers' specifications and/or other procedural components known to be appropriate to ensure scale accuracy.

The National Institute of Standards and Technology (NIST) is the federal technology agency that works with the industry to develop and apply technology, measurements, and standards. In this capacity, the NIST has a statutory responsibility for cooperation with the states in securing uniformity of weights and measures laws and methods of inspection.[7] The NIST, ISO, and ASTM, along with similar agencies around the world, have developed extensive, scientifically-based standards for calibrating weight scales. In the absence of specific guidelines from the FDA and The Joint Commission, institutions often rely on the standards developed and published by the NIST, ISO, and ASTM.

Many facilities calibrate their scales annually — unless someone requests an earlier calibration after noticing discrepancies or potential errors. The NIST specifies calibration to a minimum of 25 percent of a scale's capacity or 300 pounds — whichever is greater. Hence, using NIST standards, medical scales with capacities between 300 and 1,200 pounds should be calibrated using at least 300 pounds of certified test weight, and scales with capacities of 300 pounds or less should be calibrated at the scale's maximum capacity.[7]

[6] "Precision in Weighing: A Comparison of Scales Found in Physician Offices, Fitness Center, and Weight Loss Centers." Public Health Reports, May-June 2005
[7] "NIST Handbook 44: Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices as adopted by the 100th National Conference on Weights and Measures 2015"
[7] *Ibid*

Proving Calibration with "Traceable" Certified Weights

How do you get a weight with a "certified value" to confirm that your scale is accurate?

The National Institute of Standards and Technology (NIST), and labs authorized by the NIST to test to their standards, will certify test weights against master weights maintained by the government.

In order to be "certified," test weights must be "traceable" back to the master weights maintained by the NIST, with no gaps in the chain of certifications. Once a facility or scale service firm has its weights certified, those weights can be used for up to one year to calibrate all the scales within a system.

Hospitals, IDNs, or scale service firms can maintain their own set of weights, which they must send to the NIST or other test lab for annual re-certification.

What do I need to keep our scales calibrated?

When calibrating a scale, an operator uses a weight of a known value to compare the scale reading to the known weight, then records the result. If necessary, the scale is adjusted to accurately assess and display that known value. Some scales' hardware or firmware will automatically make this adjustment; others may require mechanical adjustment or tuning.

When calibrating a scale, the operator should follow the manufacturer's instructions and any other procedures determined by the institution. For proper calibration, it is important that the weights used have been certified by an independent test lab, have current test certificates showing the weights are within the specifications set for calibration test weights, and are traceable to the master weights maintained by the NIST.

Some hospitals and IDNs manage their scale calibration in-house, with a qualified biomedical engineer employed by the facility. While having someone in-house can be convenient, it can also be expensive when considering the employee's other duties or priorities and the costs associated with acquiring, certifying, and maintaining the weights. The logistics can become especially difficult if the hospital or IDN spans multiple buildings, requiring the employee to drive to several locations and transport the heavy certified weights.

Outside contract service companies that specialize in scale calibration can be an efficient and cost-effective alternative to in-house calibration programs. These providers already possess certified test weights in a wide variety of sizes that can be used to calibrate everything from doctor's office scales to truck scales. They are usually well-equipped to transport weights across multiple locations, and, depending on the circumstances, can cost less than in-house programs.

Calibrating Your Scale

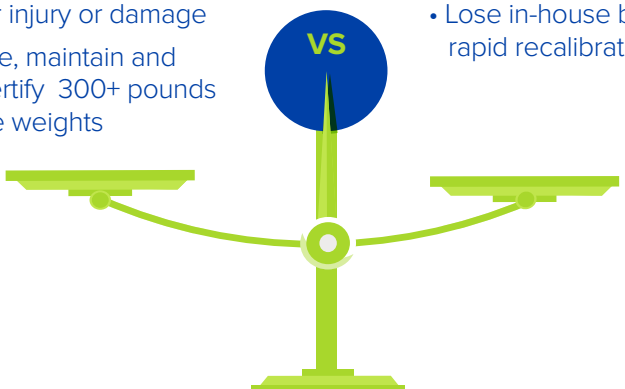
In-House Team

- Ability to React very quickly if scales need calibration
- Can be cost effective in large facilities or centrally located networks
- Hospital personnel must transport weights around hospital or IDN
- Potential for injury or damage
- Must acquire, maintain and regularly certify 300+ pounds of traceable weights

VS

Contracted Scale Services

- Already have and maintain certified weights
- Have personnel and equipment to calibrate multiple scales
- May be more cost effective for distributed health networks or large practices
- Lose in-house benefit of rapid recalibration



Establishing a Reliable Calibration Process

Step 1.

Determine responsibility and governance

Decide who should ensure that scales (and other instruments, as needed) are calibrated. This may be an internal team, such as biomedical services, facilities, or a standards department. Your facility may also decide to outsource calibration to a contracted service provider.

Step 2.

Establish frequency

Set a regular, predictable schedule for calibration. While the medical profession in the United States has not officially adopted the NIST and U.S. Department of Commerce Calibration regulations, many standards agencies recommend annual testing. Investigate whether you can align calibration with other mandates or maintenance schedules. Be sure to also implement a process for reporting anomalies and testing scales that may require calibration outside the typical schedule.

Step 3.

Follow a consistent process

Look to the NIST, The Joint Commission, the Food and Drug Administration, and other organizations to establish a consistent process that optimizes your calibration efforts. Document your process and maintain records of when the scales were last calibrated, including any needed traceability certificates.

Once you establish a process, educate your team on the importance of calibration and how inaccuracy can harm patients. A team effort can keep your scales calibrated, accurate, and safe.

About Health o meter® Professional Scales

Health o meter® Professional Scales is the market leader in medical scales and has been supplying leading technologies to the healthcare industry since 1919. Visit **homscales.com** or call **800.253.0960** to find out how Health o meter® Professional Scales can better serve you.

Costs to Consider

- Shipping and insuring hundreds of pounds of weights
- Potential injuries
- Potential damage to weights