



Replacing Mercury Thermometers with Digital Thermometers

The purpose of this factsheet is to encourage healthcare administrators to replace mercury fever thermometers with digital thermometers. Mercury is a persistent, bio-accumulative, toxic material that can harm the brain, heart, kidneys, lungs, and immune system of people of all ages. (Reference: U.S. EPA) When a mercury thermometer breaks, spilled mercury can evaporate and become an invisible, odorless toxic vapor. For this reason, efforts are underway globally to eliminate the use of mercury-containing medical devices.

The transition may not be an easy one because the cost increases seem to be enormous: the purchase price of a digital thermometer can be ten times or greater than the price of a mercury thermometer. The following section lays out a number of facts explaining why digital thermometers are indeed preferable and cost effective in the long run.

Advantages and cost-saving elements of digital thermometers

Digital thermometers avoid the shortcomings of glass/mercury thermometers and are appealing for several reasons:

- Digital thermometers are **easier and faster to use**: “Shaking down” the thermometer is eliminated. The digital thermometer senses and then beeps to indicate that the temperature reading is ready to be recorded. The digital readout can be read easily, compared with having to assess the mercury level and read the temperature scale divisions on the glass tube.
- The **risks of broken glass and exposure to mercury spills are eliminated**, as well as the time needed to clean up and safely dispose of mercury from a broken thermometer. Avoiding exposure to mercury is healthier for hospital workers, patients and visitors.
- It is likely that **fewer thermometers will be purchased each year**. Eliminating the need to shake down the thermometer decreases the likelihood of dropping and breaking the device, whether it is glass or digital. Patient-related breakage, including young patients biting on the thermometer and patients accidentally dropping the thermometer, are also eliminated.

The higher up-front cost of digital thermometers is the price a hospital pays for ease of use, reduced breakage, reduced need for replacement thermometers, a healthier environment and prevention of long term health effects caused by mercury exposure. Numerous interviews with digital thermometer users provide convincing evidence that the digital devices are viable and well-received in health care facilities.

(Continued, next page)

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Important considerations for selecting digital thermometers

Accuracy - With the variety of digital thermometers available, it is essential to ensure the quality of the tool you select. One way to do this is to seek thermometers that have been tested and shown to meet voluntary standards set by the American Society of Testing and Materials¹ (ASTM). The following table shows the maximum error allowed under the ASTM standards. (Glass/mercury and digital thermometers have the same requirements over the range of 96.4 - 106 F.)

↓ <i>Thermometer Type</i>	Maximum Error over Temperature Range Shown ^{2,3}				
	<i>Celsius Scale:</i>	<35.8 °C	35.8 °C to < 37 °C	37.0 °C to 39.0 °C	>39.0 °C to 41.0 °C
Mercury in Glass ²	± 0.3 °C	± 0.2 °C	± 0.1 °C	± 0.2 °C	± 0.3 °C
Digital Thermometers ³	± 0.3 °C	± 0.2 °C	± 0.1 °C	± 0.2 °C	± 0.3 °C
<i>Fahrenheit Scale:</i>	<96.4 °F	96.4 to < 98.0 °F	98.0 to 102.0 °F	>102 to 106 °F	>106 °F
Mercury in Glass ²	± 0.4 °F	± 0.3 °F	± 0.2 °F	± 0.3 °F	± 0.4 °F
Digital Thermometers ³	± 0.5 °F	± 0.3 °F	± 0.2 °F	± 0.3 °F	± 0.5 °F

¹ American Society of Testing and Materials (ASTM), www.astm.org, West Conshohocken, PA, USA.

² ASTM Procedure E667, Standard Specification for Mercury-in-Glass, Maximum Self-Registering Clinical Thermometers

³ ASTM Procedure E1112, Standard Specification for Electronic Thermometer for Intermittent Determination of Patient Temperature

Batteries – A drawback to digital thermometers is that most use miniature batteries, which have their own environmental impact. When you are evaluating different devices, ask the manufacturer or supplier how the thermometer is powered. There are solar powered digital thermometers on the market that completely eliminate the need for batteries. While preferable, they cost considerably more; on the order of 65% higher in cost than battery powered thermometers. If you choose a thermometer that uses a miniature battery, make sure that the battery can be replaced. Otherwise, you will have to discard the entire device when the battery wears out. Because the batteries contain metals, salts, acids and plastics, the spent (dead) batteries should be collected and recycled, rather than put in the trash.

Flexible Tips – When possible, it is best to avoid thermometers with flexible tips. Some digital thermometers have flexible tips made out of polyvinyl chloride (also called “PVC” or “vinyl”). The purpose of the flexible tip is to make the thermometer more comfortable for the patient. However PVC has both known and suspected health and environmental shortcomings at all stages: during manufacture, in use as a medical device, and after disposal. During use, a concern is that plasticizers -- additives used to make the PVC flexible (and hence more comfortable for the patient) -- can slowly leach from the PVC. There are sufficient questions about safety to avoid PVC when possible.

Evaluate alternative products – Ask for samples. A hands-on look at the digital thermometers is essential. If the samples look promising, do a small scale clinical trial in the hospital. Look closely at employee feedback. This will help rule out inferior devices or, from criticism and questions raised, will identify key points to communicate during widespread introduction and training for the new thermometers. When you buy a new device, consider using the manufacturer’s representative for training staff and to introduce the new product to all the different departments in the hospital. Encourage staff members to question and offer constructive criticism to the manufacturer’s representative. The representative is a direct link back to the design engineers and this is one way products get refined and improved.

Keep purchasing agreements flexible – The first thermometer you select may prove over time to have drawbacks that you don’t want to live with. Make sure you have the freedom to procure different thermometers if this happens.

Be prepared for uncertainty when selecting a product – There are no perfect products. For example, which is preferable: a solar-powered thermometer with a PVC flexible tip or a battery-powered thermometer without PVC? In situations like this, see if the supplier has a product with the best of both alternatives: a solar powered thermometer without PVC. Look at the bigger picture for guidance. Finally, remember that either type of digital thermometer is safer than a mercury thermometer.

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