Case Study: Using ATP Monitoring to Maintain Hospital Ultrasound Equipment

Ultrasound is a popular and straightforward way for healthcare providers to diagnose a range of conditions affecting organs and tissues, including the uterus, ovaries, heart and blood vessels, liver, gallbladder, spleen, pancreas and kidneys. It is perhaps best known as a monitor of a woman's pregnancy.

Ultrasound uses high-frequency sound waves to create and retrieve real-time, detailed images from inside the body. It most commonly relies on a non-invasive wand (called the probe) which is placed on the skin above the area and organs of interest and acts as a transducer, converting sound waves into images. Ultrasound also can be a vector for transmitting pathogens to patients and facility staff. Bacteria can be found on the transducer probe itself, but also on related keyboards, connectors, gel bottles and machine handles. The risk of cross infection from the various components of ultrasound probes is estimated at about 3.1 percent of all patients, which is of concern considering the ubiquity of this clinical tool.

In Australia, hospitals follow established guidelines on cleaning reusable ultrasound probes and equipment, and intensive disinfection to reprocess intracavity probes for reuse is accepted as necessary to reduce contamination risk. However, a recent survey showed a distinct lack of understanding among hospital staff about the need to conduct low-level disinfection of all scanning equipment after every use. If gross contaminants are not removed before low-level disinfection, subsequent cleaning efforts could be compromised, and persistent viruses and bacteria would be allowed to survive.

Visual inspection will not prevent contamination, as one study showed. In that study, only 51 percent of blood-contaminated samples were visibly stained and, in another study, 23 percent of external (noninvasive) transducers were contaminated after a patient scan.

To examine the effect of regular cleaning and disinfection, researchers from three Australian universities, the Australasian Society for Ultrasound in Medicine and the Whiteley Corporation studied cleanliness standards and contamination in five health care facilities in the city of Sydney. Their results were published online in the *American Journal of Infection Control*.

At the five Sydney ultrasound facilities, 253 surfaces were tested using the Hygiena ATP Cleaning Monitoring System, provided through Hygiena's distributor, Key Diagnostics, in Sylvania, Australia. The ATP luminometer system measures levels of ATP in a sample, which indicates the presence of living cells and organic matter on a surface and reads out those levels in Relative Light Units (RLUs). The higher the RLU, the more contamination is present. An initial cleanliness threshold of 100 RLUs was established for the Sydney ultrasound study. "Clean" was defined as 25 RLUs or less.

A cleaning intervention step was taken after the initial reading, and surfaces were then retested for ATP.

Of the 253 surfaces, 26% showed possible or definite lack of cleanliness (RLU readings at 100 or above). A cleaning intervention step was taken on 148 of the surfaces and showed that cleaning standards could be improved for 91% of those surfaces. For 6%, the cleaning intervention had to be conducted more than once to arrive at the intended level of cleanliness (below 25 RLUs, see Table 1 below). All equipment was found to be dirty more than once. Of all surfaces, the ultrasound gel bottle and chairs were most likely to be dirty (46 percent and 44 percent, respectively; see Table 2 below).

Table 1: Percent "dirty" RLU before and after cleaning steps.

Precleaning RLU >100	Initial cleaning improvement	Repeated cleaning needed	Cleaning needed at least once
26	91	6	100

Table 2: Percent "dirty" RLU by equipment type, before cleaning

Screen	Gel bottle	Chair	Machine grip	Probe head	Keyboard	Probe connector
66.7	46.4	42.9	25.0	11.0	9.8	4.5

The study showed that physical appearance did not reliably reflect the actual cleanliness of the ultrasound apparatus, pointing to a need for ATP monitoring as a way to determine cleaning effectiveness. For cleaning in place (CIS) methods, repeated cleaning steps were required to bring RLUs down to an acceptable level, and in a few instances, ATP levels (measured by RLUs) actually increased, indicating that a surface was challenging to clean, or a surface had residual organic matter that required multiple efforts to remove. In these cases, none of the organic matter was observable without using ATP monitoring. However, ultimately, nearly all clinical ultrasound equipment could be kept clean using a rigorous cleaning program and an ATP luminometer to track progress.