What Time Is It? The Case for Synchronizing Clinical Times

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A basic assumption of clinical records is that recorded times are accurate enough to represent a course of events. While this should be true of manually recorded records, with the increase in automated record keeping (clinical and administrative) it will be ever more essential to maintain consistent time references throughout healthcare institutions.

When used for OR management, recorded event times are used to calculate intervals such as turnover that are commonly employed by management. However, when clocks used for reference are not synchronized, the calculated intervals become meaningless. For example, when operating and recovery room clocks are not synchronized we have observed alleged arrival in recovery 12 minutes before leaving the OR. Such a time warp would indeed provide a competitive advantage if it could be reliably engaged!

Unsynchronized clocks can have adverse legal consequences. The times on maternal-fetal labor-FHR monitors are the reference standard in obstetrics. However, those times are often difficult to read and frequently deviate from times read from wall clocks in labor rooms by 5-10 minutes. In our Labor and Delivery suite the server for the fetal monitoring system can be synchronized to a network time standard, but the maternal-fetal monitors in individual rooms cannot be synchronized with the server or each other. Thus when a patient is moved from a labor room to an operating room for a C-section, there are additional time uncertainties introduced by new wall clocks and fetal monitor strips showing printed nominal times. In cases of undesirable outcomes, the uncertainties in time can be the foundation of a plaintiff's theory, even if unfounded on the basis of clinical notes or recall; and the statute of limitations can be 23 years.

Many unsynchronized time sources have been discovered, many unexpected: wall clocks (Simplex and autonomous), monitors (many manufacturers), computers (networked, with and without active time clients), maternal-fetal monitors (individual and server-based), watches, digital telephones. Furthermore, staff created further ambiguity with manually recorded times on billing registries representing such guesses as "When did we come into the OR?", or "How long will you take going to ICU?"

Numerous partial solutions for synchronizing some time references were discovered. However, a unified solution employing a single local time reference is elusive. Systems referenced to an external source, such as GPS satellite time, could drift apart if one or both lose their ability to synchronize with the primary source, e.g. if the individual device's ability to synchronize to the satellite becomes dysfunctional. If all local systems are synchronized to an internal reference source, even if the internal reference drifts from the official US NIST reference, local devices will remain internally consistent with the local standard. Network reference clocks employing GPS, WWVB radio, or the Internet to synchronize with the US atomic reference clocks are readily available. The externally obtained time is distributed over computer networks using the NTP protocol. Analog and digital clocks that are networked NTP clients are available and less expensive the traditional Simplex clock synchronization systems. For installed Simplex clock networks, Simplex masters that are NTP clients are available. Master clocks that acquire a GPS time reference and synchronize local clocks using a local FCC licensed radio frequency are available. These have about a 400 foot spherical redistribution radius, so multiple base stations may be required, any of which could become de-referenced. There were no systems discovered that can be a client to a local NTP reference and use radio to synchronize slave clocks. The server setting the time displayed by digital telephones cannot be synchronized to an NTP reference; it is set manually once weekly. Numerous monitors display and even print times on hardcopy; however these internal clocks cannot even be set by users in many cases. If the user is not cognizant of erroneous internal time settings in monitors, offset times are frequently recorded in manual records, especially when tabular data summaries are used to complete clinical records after lapses in record keeping due to other more important clinical activities.

The presentation will review 1.) The discovery of existing unsynchronized time references, and 2.) Resources to synchronize clocks of networked computers and human readable timepieces.