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AMERICAN ASSOCIATION of CRITICAL-CARE NURSES

Time Out! Is Timepiece Variability a Factor in Critical Care?

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• Background *Accurate documentation of time is essential in critical care for treatments, interventions, research, and medicolegal and quality improvement activities.*
• Objectives *To assess use of timepieces in critical care and to determine practical methods for improving their accuracy.*
• Methods *Providers were surveyed to identify timepieces used during routine and emergency care. Times displayed on standard unit and personal timepieces were compared with coordinated universal time. Four models of atomic clocks were assessed for drift for 6 weeks and for resynchronization for 1 week. Bedside monitors were manually synchronized to coordinated universal time and were assessed for drift.*
• Results *Survey response was 78% (149/190). Nurses (n = 93), physicians (n = 32), and respiratory therapists (n = 24) use wall clocks (50%) and personal timepieces (46%) most frequently during emergencies. The difference from coordinated universal time was a median of -4 minutes (range, -5 minutes to +2 min) for wall clocks, -2.5 minutes (-90 minutes to -1 minute) for monitors, and 0 minutes (-22 minutes to +12 minutes) for personal timepieces. Kruskal-Wallis testing indicated significant variations for all classes of timepieces (*$P < .001$*) and for personal timepieces grouped by discipline (*$P = .02$*). Atomic clocks were accurate to 30 seconds of coordinated universal time for 6 weeks when manually set but could not be synchronized by radiofrequency signal. Drift of bedside monitors was 1 minute.*
• Conclusions *Timepieces used in critical care are highly variable and inaccurate. Manually synchronizing timepieces to coordinated universal time improved accuracy for several weeks, but the feasibility of synchronizing all timepieces is undetermined. (American Journal of Critical Care. 2005;14:113-120)*

Accurate documentation of time is essential in the dynamic critical care setting. Outcomes depend on precise timing of interventions, especially in emergency situations. In a pediatric critical care setting, multiple timepieces are used by practitioners for documentation: personal timepieces, wall clocks, beepers, monitors, and so on. Use of different timepieces affects the accuracy of time documentation on patients' records and blurs the reconstruction of events, treatments, and responses. These inaccuracies may have a major effect on interventions, research, and medicolegal and quality improvement activities.

Treatments based on small time intervals are the focus of research on resuscitation. As a result, timepiece accuracy becomes an important variable for validity of resuscitation research. Much of the literature on time documentation comes from research in emergency medical services. The timing of emergency treatments can have a major effect on patients' outcomes, yet measurements of the interval before emergency treatment is provided are often based on estimates.[1] Becker et al[1]

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found time discrepancies in 39% of the out-of-hospital cardiac arrests studied and revealed documentation that indicated intervention by emergency medical services personnel occurred before any indication for medical assistance was apparent.[1]

Outcomes are dependent on precise timing of interventions.

The task force of the American Heart Association, the European Resuscitation Council, the Heart and Stroke Foundation of Canada, and the Australian Resuscitation Council has addressed the inconsistencies in international research. In their recommendations for a uniform method of reporting resuscitation studies, they emphasized the importance of time intervals and the need for use of a standardized time.[2] Direct observation has been proposed and tested as a means of assessing treatment intervals accurately for research purposes.[3] The variation in time displayed on wall clocks and watches calls into question the validity of the precise timing of events in the resuscitation of neonates.[4] Similar discrepancies have also been observed among timepieces used in emergency departments and by emergency medical services personnel.[5] The validity of research on resuscitation has been questioned because of the inaccuracies in time documentation for interventions linked to very small time intervals.[6,7]

Methods

Approval from the hospital's institutional review board was obtained before this prospective, descriptive study was done.

Time discrepancies exist in 39% of out-of-hospital cardiac arrests studied.

Subjects and Setting

This study was conducted in 2 critical care areas in a large, urban, pediatric tertiary care setting. One area was a 38-bed pediatric intensive care unit (PICU). The second area was a 12-bed pediatric respiratory rehabilitation unit (RRU). These areas were located in 2 separate buildings of the medical campus.

All nurses, respiratory therapists, and physicians employed in the PICU and RRU were included as potential respondents. These healthcare professionals included 130 nurses, 28 respiratory therapists, and 32 physicians who are in the unique position of documenting time associated with patient care.

Appendix A

Modified time record survey
DATE: _____

1. Workplace
   a. PICU
   b. 4E CSSH (RRU)

2. Role in the PICU/4E CSSH (RRU)
   a. Nurse
   b. Physician
   c. Respiratory therapist
   d. Nursing tech

3. Timepiece that you most frequently use during routine treatments/interventions.
   a. Patient's wall clock
   b. Patient's monitor clock
   c. Personal wristwatch
   d. Beeper (pager)
   e. Other _____

4. Timepiece that you most frequently use during emergency/code blue treatments/interventions.
   a. Patient's wall clock
   b. Patient's monitor clock
   c. Personal wristwatch
   d. Beeper
   e. other _____

5. Would you reset your personal wristwatch to a standard time for the unit?
   a. Yes
   b. No
   c. Possibly

6. As you turn in this survey, please tell me what time your personal wristwatch reads now.
   Personal wristwatch time _____
   Atomic time _____

Abbreviations: 4E CSSH (RRU), pediatric respiratory rehabilitation unit; PICU, pediatric intensive care unit.

Instruments

Four atomic clock models were tested in the PICU: Seiko Global Radio Wave Alarm QHR007G, Seiko Corporation, Tokyo, Japan; Sharper Image US Atomic Travel Alarm Clock, Sharper Image Corporation, San Francisco, Calif; Oregon Scientific Radio Controlled Projection Clock with HiGlo Backlight RM 313 PA, Oregon Scientific, Portland, Ore; and Exacta Radio Controlled Clock C-842 WWD, Peking, China. Atomic clocks are designed to receive radiofrequency transmissions of time signals several times a day to autoadjust the time. A receiving tower signal blinks during trans-

mission and remains steady once the clock has been updated. The time is kept to within 1 μs of coordinated universal time (UTC) at the transmitter site. Despite a delay with added distance from the site or as a result of the signal bouncing between Earth and the ionosphere, most clocks in the United States accurately receive the time within 1/1000 of a second.

Procedure

Nurses, respiratory therapists, and physicians employed in the PICU and RRU were surveyed by using a modified time record survey tool (Appendix A). This tool is a modification of the one used by Chamberlin and Nadkarni.[8] The survey was used to collect information about the timepieces staff preferred to use during routine and emergency documentation. The tool was also used to gather data on the time displayed on personal timepieces compared with UTC.

UTC was compared with the time noted from personal and standard unit timepieces. The difference between UTC and the documented time was calculated and recorded to the nearest minute. Variability in central and bedside timepieces such as wall clocks, central monitoring systems, bedside monitors, and computers was assessed and was compared with UTC.

Central monitors (Hewlett Packard M2360A, Hewlett Packard 712/60, Hewlett Packard 78560A, Philips Medical Systems, NA, Bothell, Wash) were manually synchronized to UTC and compared over 5 weeks for drift. The difference between UTC and time displayed on the monitors, ΔT, was calculated to the nearest minute. ΔT was calculated as (timepiece time - UTC), so a ΔT greater than 0 indicates that the timepiece time is ahead of UTC.

All 4 models of atomic clocks were placed on each of 3 code carts located in the PICU and RRU. In order to detect drift of the atomic clocks, they were manually synchronized to UTC and placed in locked, plastic boxes. The time on each clock was noted once a week at the same time every week for 6 consecutive weeks. Drift was defined relative to UTC posted on the Internet (http://nist.time.gov/timezone.cgi?Eastern/d/-5/java). On the seventh week, each atomic clock was manually reset 1 hour ahead to determine its ability to reset to UTC by radio signal after 24 hours, 72 hours, and 1 week.

Data Analysis

Microsoft Excel (Microsoft Corporation, Redmond, Wash) was used for data management. Stata, versions 7.0 and 8.0 (StataCorp LP, College Station, Tex) were used for data analysis. Descriptive statistics were calculated, including means, medians, SDs, and ranges.

Table 1 Timepieces used by critical care practitioners during routine and emergency care*

	No. (%) of practitioners using during	
Timepiece	Routine care	Emergency care
Wall	36.5 (24)	73 (50)
Monitor	2 (1)	5 (3)
Watch	105.5 (71)	67.5 (46)
Beeper	3.5 (2)	0.5 (0)
Other	1.5 (1)	1 (1)

*Some respondents listed 2 different timepieces for a given care situation. In that case, their response was counted as 0.5 for each timepiece they listed.
Some respondents did not indicate a timepiece preference for emergency care; therefore, the total number of responses for routine and emergency care are not equal.

Responses from the survey were categorized by practitioner group and by practice location. If respondents selected 2 responses to a given item in the tool, each response was counted but was given a weight of ½ for purposes of summary and comparison statistics. The responses from the survey were counted, rounding up for noninteger totals, and compared by using χ^2 analysis.

Because the timepiece data were not normally distributed, nonparametric comparisons were used to analyze the results. Kruskal-Wallis testing was used to compare time differences among multiple groups, and Wilcoxon rank-sum testing was used for paired comparisons.

Results

Staff Timepiece Preferences

Of 190 potential respondents, 149 completed the survey. The majority of practitioners who responded were nurses: 74 PICU nurses, 19 RRU nurses, 30 PICU physicians, 2 RRU physicians, 19 PICU respiratory therapists, and 5 RRU respiratory therapists. The number of respondents is smaller in the RRU because that unit has fewer staff members overall.

Fourteen respondents selected 2 choices for at least 1 of the items on the survey. Three respondents did not complete all items on the survey. Table 1 is a summary of the responses. Most practitioners used either a wristwatch or a wall clock to determine time for documentation of both routine and emergency care. Seventy-one percent of practitioners preferred to use personal timepieces (eg, wristwatches) for routine care. Fifty percent preferred to use wall clocks during emergencies. This shift in timepiece preference was more prominent among the PICU staff than among the RRU staff, and among practitioners other than nurses rather than among nurses. Figures 1 and 2 graphically demonstrate this shift in preference depending on clinical scenario. According to χ^2 analysis, timepiece preference differed

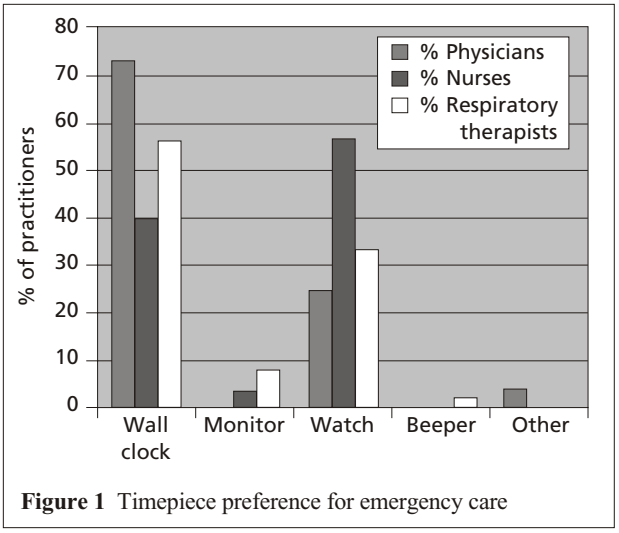

Figure 1 Timepiece preference for emergency care

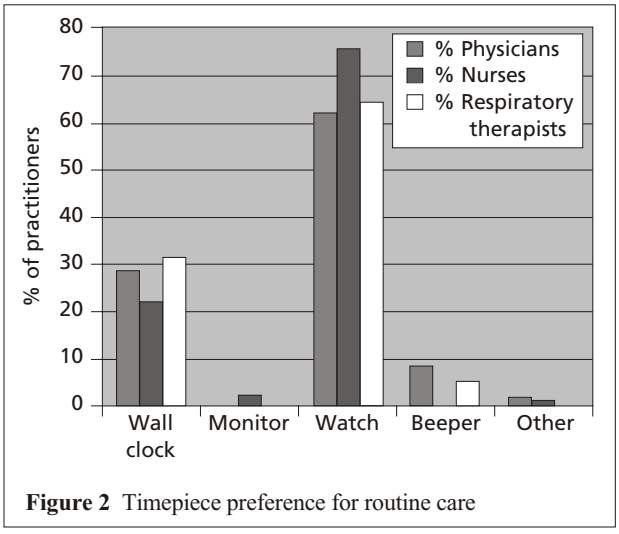

Figure 2 Timepiece preference for routine care

significantly between nurses and physicians when grouped across practice location. Nurses favored using wristwatches over wall clocks in both situations, but less so for emergency situations ($P = .03$). Physicians favored wristwatches over wall clocks for routine situations, but reversed their preference for emergencies ($P = .003$). Respiratory therapists had a preference shift similar to that of physicians, but this difference was not statistically significant ($P = .10$).

As summarized in Table 2, a majority of practitioners expressed willingness to synchronize their personal timepieces with an external standard, although the response was not unanimous: 64% responded yes, 16% no, and 20% possibly.

The profile of responses to this item varied significantly by practice group (overall $P = .002$), primarily because of the physicians (physician vs nurse $P < .001$, physician vs respiratory therapist $P = .13$).

Most practitioners use a wristwatch or wall clock for both routine and emergency care, but physicians had a greater preference than nurses for using a wall clock during emergencies.

Features of Timepieces in Clinical Care Areas

Differences from UTC (ΔT) were recorded for timepieces found in the clinical care areas. Timepieces tracked included staff wristwatches and beepers, wall clocks, bedside and central patient monitors, workstation computers, and clocks on videocassette recorders. As seen in Figures 3 and 4 and Table 3, the distribution of ΔT values in both care areas was wide.

Kruskal-Wallis testing indicated significant variations in ΔT for all timepieces ($P < .001$), even when stratified by care area ($P < .001$) and by discipline (nurse vs physician vs respiratory therapist, $P = .016$). By rank-sum testing, paired comparisons between the disciplines indicated that ΔT differed significantly between physicians and respiratory therapists ($P = .004$). Differences in ΔT between physicians and nurses ($P = .05$) and between nurses and respiratory therapists ($P = .12$) were not significant.

Drift of Time on Bedside Monitors

Drift of monitors (n = 51) was 1 minute or less over a 1-week period. When it was confirmed that the clocks on the PICU bedside monitors were synchronized by the central monitoring system, only the central monitoring systems were monitored in the PICU. Thirteen bedside patient monitors that were not centrally synchronized in the RRU and 7 central and clinical event review monitors in the PICU were followed up for an additional 4 weeks to assess for time drift. After 5 weeks, the RRU had 2 monitors (15%) without drift and 11 monitors (85%) that lagged 1 minute. In the PICU, 1 clinical event review monitor (14%) had no measurable drift, 5 central monitors (71%) were slow by 1 minute, and 1 clinical event review monitor (14%) was slow by 2 minutes compared with UTC.

Features of Atomic Clocks in Clinical Care Areas

None of the 12 atomic clocks were able to resynchronize to the central transmitter signal when placed on the code carts in the clinical care areas. After being manually set, 11 atomic clocks were accurate to within 30 seconds of UTC at the end of the 6-week observation period. One atomic clock was ahead of UTC by

Table 2 Willingness of practitioners to synchronize personal timepieces*

	Would you reset your personal wristwatch to a standard time for the unit?		
Practitioner	Yes	No	Possibly
Nurse	67 (72.0)	8 (8.6)	18 (19.4)
Respiratory therapist	13 (54.2)	4 (16.7)	7 (29.2)
Physician†	15 (48.4)	12 (38.7)	4 (12.9)

*Values are No. (%) of practitioners. Because of rounding, percentages may not all total 100.
†One physician respondent did not reply to this question.

more than 4 hours after the fifth week. It was speculated that this clock might have been accidentally jarred and offset. The atomic clocks had a tendency to drift incrementally over the observation period (Figure 5). The clocks tended to drift ahead of UTC by a few seconds per week, with a mean of 7.1 seconds for the 6 weeks. All of the same 12 clocks were able to resynchronize to the central radio-transmitter signal when placed in a window outside of the hospital setting.

Significant differences were found between all timepieces and atomic time.

Discussion

In multiple healthcare settings, studies[3,6,8-10] have indicated significant variability in time found on timepieces used. Lerner et al[10] found time deviations from UTC when comparing timepieces from 25 emergency dispatch centers. The difference from UTC they observed ranged from -551 to +117 seconds. In a study[6] of emergency medical services in a large metropolitan setting, timepieces varied a mean of 1 minute 45 seconds from UTC, with a range of more than 19 minutes. Fifty-five percent of timepieces in that study[6] varied more than 1 minute from UTC. Time deviations from an atomic clock have been reported to range widely from 14 to 70.7 minutes in a pediatric emergency department and intensive care settings.[8] Automatically resetting atomic clocks was not practical for those settings and it was recommended that automated synchrony be further evaluated. One-time synchronization of multiple timepieces to UTC reduces the discrepancies among the times displayed by different timepieces, but the effects of a single synchronization are short-lived.[9]

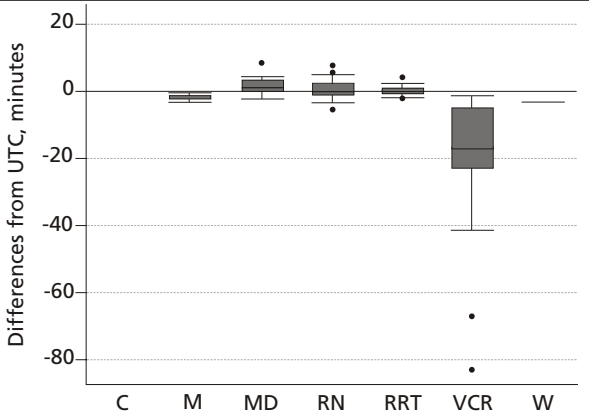

Figure 3 Differences between timepieces in the pediatric intensive care unit and coordinated universal time (UTC)

Abbreviations: C, computers; M, monitors; MD, physicians' personal timepieces; RN, nurses' personal timepieces; RRT, respiratory therapists' personal timepieces; VCR, clock on videocassette recorder; W, wall clock.

Staff Preferences for Timepieces

Our study is the first in which staff members' preferences for timepieces in the pediatric critical care setting were examined. Timepiece preference varies significantly among pediatric critical care practitioners. Most prefer personal timepieces (eg, wristwatches) for documentation of routine care interventions. Practitioners tended to change their timepiece preference for documentation of emergency care interventions, favoring wall clocks over other timepieces. The change in preference was more prominent among physicians than among other practitioners. Although the shift to wall clocks also occurred among the nurses, most nurses continue to use personal timepieces during emergencies. Thus, accuracy of both personal timepieces and wall clocks is important.

Synchronization to Coordinated Universal Time

UTC is not currently the reference standard for time at this institution. In fact, no standard time source or reference has been established, yet our results revealed the significant variability in times displayed on the unit and the personal timepieces used in documentation. Staff members do not routinely set their personal timepieces to UTC. Neither the practicality nor the feasibility of doing so was evaluated during this study. Perhaps the precision of timekeeping devices, rather than their accuracy, is what is important. The specific time standard to which practitioners synchronize their timepieces does not matter so long as the same standards are used for both their timepieces and other hospital devices. Although the majority of caregivers indicated that they would be willing to synchronize their timepieces, the responses were mixed (Table 2).

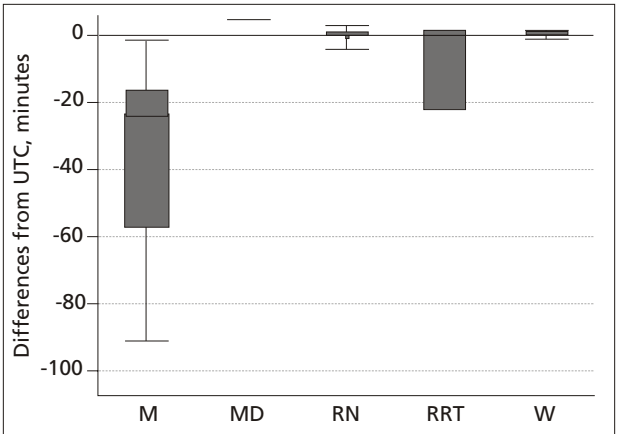

Figure 4 Differences between timepieces in the respiratory rehabilitation unit and coordinated universal time (UTC)

Abbreviations: M, monitors; MD, physicians' personal timepieces; RN, nurses' personal timepieces; RRT, respiratory therapists' personal timepieces; W, wall clock.

Once the centralized bedside monitoring system was synchronized to UTC, the drift in time that occurred was 1 minute. This finding suggests that routine resynchronization to UTC might be an option with this type of monitoring system. However, the feasibility of synchronizing all critical care equipment that has a time function (eg, defibrillators, ventilators, electrocardiographic equipment) is unknown. Information about patients and interventions can often be retrieved from these machines. If the time recorded on those machines is inconsistent with the monitor time, the value of synchronization of monitors to UTC may be questionable.

New innovations such as Bluetooth technology that wirelessly link various pieces of equipment may provide a practical mechanism by which local critical care equipment can be synchronized to a standard time. However, this technology does not work over long distances. Other technologies, such as synchronization with radionavigation satellites and ground stations in the worldwide global positioning system, may be more practical for synchronizing timepieces across an entire enterprise. If all time sources in the unit and related to patients' care (eg, wall clock, monitor, computer, defibrillator, ventilator, electrocardiographic equipment, computerized order entry systems, laboratory systems) were accurate, then documentation of emergency events with accurate timing would be facilitated.

Timepieces used in critical care are highly variable and inaccurate, but synchronization of all time-keeping equipment is complex.

Table 3 Differences from coordinated universal time in minutes

Timepiece	N*	Mean	Median	Range
Computer	23	-0.087	0	-2, +1
Monitor	56	-9.02	-2.5	-90, -1
Physician's watch	28	2.07	1	-3, +12
Nurse's watch	85	0.588	0	-8, +11
Respiratory therapist's watch	21	-1.10	0	-22, +6
All watches	134	0.634	0	-22, 12
Clock on videocassette recorder	24	-20.1	-17	-83, -1
Wall clock	26	-2.23	-4	-5, +2

*The *N* here for providers is less than the number of respondents because some respondents did not enter a timepiece or atomic clock time.

Usefulness of Atomic Clocks in a Hospital Setting

When each of the 4 models of atomic clock was reset to an erroneous time, none were able to resynchronize to the central radio transmitter signal while on code carts in 3 different locations. This result suggests that these models of atomic clock are not a suitable option for use within the 2 critical care units where they were studied. Interfering factors may have included the construction activities that were occurring at the time of the study, the plastic lockboxes in which the clocks were housed, and the effects of other technological equipment used in critical care settings. We confirmed that the atomic clocks evaluated could resynchronize outside of the hospital campus.

Limitations and Future Research

This study involved a single center and used a convenience sample and self-report. Although many models of atomic clock are available, we used only 4 commercially available models from different manufacturers. Finally, the study was limited by the assumption of a direct relationship between timepiece accuracy and documentation accuracy.

Further research is needed to determine the effect of timepiece variability on documentation of both routine and emergency interventions. Direct observation of documentation may be one method by which to accomplish this. An investigation of synchronization of the timepieces most frequently used (wall clocks and personal timepieces) could provide changes in practice that are relatively easily implemented.

The synchronization of wall clocks and other hospital equipment may be facilitated by new technology that can bring the UTC signal into the hospital structure effectively, such as synchronization with global positioning system satellites.

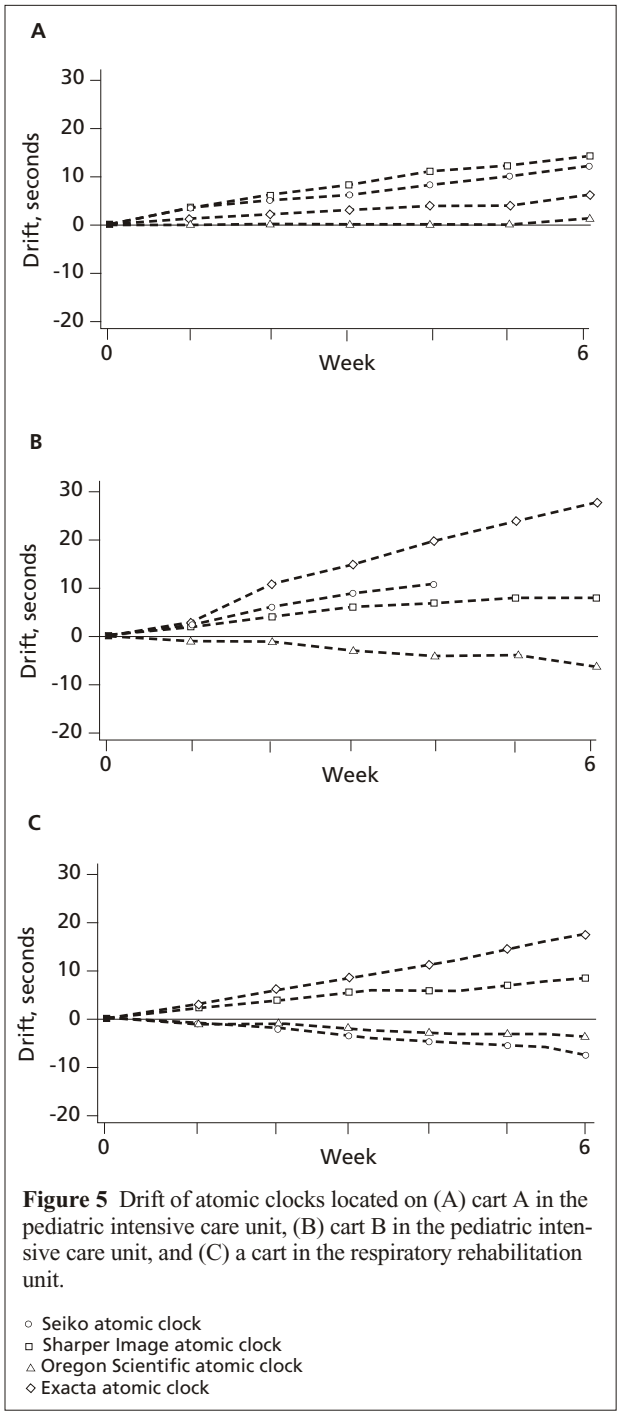

Figure 5 Drift of atomic clocks located on (A) cart A in the pediatric intensive care unit, (B) cart B in the pediatric intensive care unit, and (C) a cart in the respiratory rehabilitation unit.

Assessment of personal timepiece synchronization and drift from UTC could yield valuable information for narrowing the variability of personal timepieces. However, we found that practitioners often set their personal timepieces ahead to compensate for their lifestyles. Investigating practitioners' willingness to use an accurate alternative timepiece such as a synchronized bedside monitor or synchronized wall clock rather than a personal timepiece would provide helpful information on how to change practice.

Conclusion

A standard, reliable, and easily accessible source of accurate time for assessment and documentation is necessary in critical care. Our data revealed that multiple timepieces with various degrees of accuracy are used in the pediatric critical care setting. The variability in accuracy can adversely affect patients' records, potentially affecting immediate patient care, as well as future medicolegal, continuous quality improvement, and resuscitation research activities. Conventional atomic clocks did not receive the automated radiofrequency signal for synchronization in the hospital setting. Synchronization of bedside and central monitors does provide an accurate timepiece in the areas devoted to patient care. Synchronization could be a cost-effective method for improving timepiece accuracy in this setting. Further evaluation of automated and manual synchronization of all types of timepieces will provide valuable information for improving clinical practice.

ACKNOWLEDGMENTS

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JOURNAL CLUB ARTICLE DISCUSSION POINTS

In a journal club, research articles are reviewed and critiqued. General and specific questions help to aid journal club participants in probing the quality of the research study, the appropriateness of the study design and methods, the validity of the conclusions, and the implications for practice.

When critically appraising this issue's *AJCC* journal club article, "Time Out! Is Timepiece Variability a Factor in Critical Care?," consider the questions and discussion points listed below.

Study Synopsis: The purpose of this study was to assess the differences that existed in timepiece use patterns among registered nurses, physicians, and respiratory therapists in critical care and to determine methods to improve timepiece accuracy. Staff in 2 critical care units (n = 149) responded to surveys assessing their use of fixed and personal timepieces during routine and emergency care. In addition, times displayed on fixed and personal timepieces were compared with coordinated universal time (UTC), and 4 models of atomic clocks were used in the unit and assessed for accuracy during a 6-week period. Bedside monitors were synchronized to UTC and assessed for drift. Study respondents (93 nurses, 32 physicians, and 24 respiratory therapists) reported their use of wall clocks (51.0%) and personal clocks (46.3%) to occur most frequently during emergencies. Variability was found among the accuracy of time measured by wall clocks, personal clocks, and monitors. The synchronized bedside monitors were found to have a drift of up to 1 minute. Atomic clocks were accurate to 1 minute for 6 weeks when set manually, but they were unable to synchronize by radio frequency signal. The study results show that the timepieces used in critical care are highly variable and inaccurate.

A. Description of the Study
- What was the purpose of the research?
- What aspects of critical care do inaccuracies in time measurement affect?
- Why is the problem significant to critical care nursing?

B. Methods and Design
- Describe the procedures that were used to assess time variability.
- What was the rationale for studying the use of atomic clocks in the intensive care unit (ICU)?

C. Results
- What was the most preferred method for determining time for documentation of routine and emergency care?
- How did these methods differ?
- What were the differences among critical care provider groups?
- What were the study results with respect to the accuracy of different timepieces used in the ICU?

D. Clinical Significance
- What are implications of the study for clinical nursing?
- What types of timepieces are used in your critical care work area, and what aspects of the study have implications for your practice?

Information From the Authors: Elizabeth Ferguson, lead author of this journal club article, provided additional information about the study. She explained that the idea for the study was chosen among several that the ICU team had identified as important to practice. She shared, "The multidisciplinary Critical Care Research Committee decided to conduct research studies to provide bedside nurses an opportunity to engage in and develop research in the critical care setting. The time study was chosen for several reasons, including that it was a topic of interest, had a short timeline, the costs were minimal, and the findings would be relevant to the unit." Ferguson explained that the research team members actively participated in the study. She shared, "The coinvestigator team did the data collection based on a weekly rotating schedule that was developed before the start of data collection. We established guidelines and standards for the various data elements." Information on certain timed tasks was not assessed. Ferguson explained, "We decided not to ask which timepiece people used when sending labs because this time was automated in our computer system."

With respect to the results, Ferguson shared that several findings were of interest. She related, "While the preferred timepiece shifts from the personal timepiece during routine interventions to the wall clock during emergency interventions for the combined group of practitioners, it is interesting to note that the shift to wall clocks is not as significant for nurses as for respiratory therapists and physicians. Most nurses continue to use their personal timepieces in both routine and emergency situations. Personal timepieces also proved to be the most accurate. These results may indicate that nurses are aware of the inaccuracies of the other timepieces in patient care areas and therefore continue to use the more accurate personal timepiece." Kathryn Roberts, a co-author, added that the inability of the atomic clocks to resynchronize was a surprising finding. Roberts shared, "We were surprised and a little disappointed to find that none of the atomic clocks were able to automatically synchronize themselves with the radio frequency signal. This finding requires further investigation, but it most likely reflects that the signal reception from the areas we studied is poor."

Implications for Practice: The study results show that variability does exist among timepieces used in the ICU setting. This finding has implications for practice not only for documentation purposes, but also for interventions and procedures performed in the ICU. Ferguson added, "This study has significant implications for patient care, research, and medicolegal and quality improvement activities in the critical care setting. It highlights a topic area that will impact documentation accuracy, risk management, medical error assessment, and patient outcomes. One important question that needs to be answered is whether it is more important to improve timepiece accuracy during crucial minutes in a code, or do we first need to establish the nature of the relationship between accurate timepiece and time documentation/outcomes." As the study highlights, additional research is needed to determine the effect of timepiece variability as well as methods to promote accuracy in timepiece use in the ICU, especially as technologies evolve.

Journal Club feature commentary is provided by Ruth Kleinpell.