

Wristband Identification Error Reporting in 712 Hospitals

A College of American Pathologists' Q-Probes Study of Quality Issues in Transfusion Practice

Stephen W. Renner, MD; Peter J. Howanitz, MD; Paul Bachner, MD

• The correct wristband identification of patients is essential to prevent acute, hemolytic transfusion reactions from incompatible transfusion. We compared wristband identification errors for 712 hospitals. Phlebotomists checked patient wristbands on 2 463 727 occasions, finding 67 289 errors; in 33 308 instances, patient wristbands were missing entirely. The median total error rate was 2.2%; 10% of participants had error rates of 10.9% or greater. Absent wristbands represented 49.5% of errors; multiple wristbands with different information, 8.3%; wristbands with incomplete data, 7.5%; erroneous data, 8.6%; illegible data, 5.7%; and patients wearing wristbands with another patient's identifying information, 0.5%. The monitoring for errors by phlebotomy staff was the most important policy associated with lower error rates. Initial placement of wristbands by nursing staff was the only policy associated with increased error rates. We conclude that wristband identification error rates depend on differences in hospital policy and procedure and should be responsive to quality improvement efforts.

(*Arch Pathol Lab Med.* 1993;117:573-577)

Correct identification of hospitalized patients is essential to their safety. The maintenance of a chain of identity for laboratory results starts with the patient's wristband. A blood specimen taken from the wrong patient or labeled with mistaken wristband information may result in a hemolytic transfusion reaction from an incompatible transfusion, due to irrelevant blood typing and crossmatch test results. A correct wristband must be present at the time of phlebotomy to permit matching of information on a blood unit label with patient identification before the start of a transfusion.¹

In reviews of incompatible transfusions in surgical or intensive care facilities, over three fourths of all prevent-

able deaths were from clerical errors involving patient identification.² Many of these fatalities were caused by failure to follow established procedures for matching blood unit label details to wristband identification. In other cases, absent wristbands or other wristband identification lapses were culpable in the transfusion of blood crossmatched for one patient to another.^{1,3,4} The details of wristband identification can be especially crucial to patient safety. Sazama⁵ reported 10 deaths from 1976 through 1985 in which the actual and intended recipients of transfusions had the same last name and five deaths in which the two shared the same hospital room.

To better understand the nature of clerical errors leading to incompatible transfusions, we studied wristband identification errors in North American hospitals. This is the first report on interinstitutional comparison of wristband identification errors, to our knowledge. The purpose of this study was to measure the influence that several hospital policies and procedures regarding phlebotomy, patient identification, and wristband monitoring had on error rates and to validate a protocol for measuring intrainstitutional error rates that participants could continue to use to monitor their improvement.

MATERIALS AND METHODS

Participants who enrolled in the College of American Pathologists' (CAP) Q-Probes program for the first quarter in 1991 participated in the study. Instructions for the study were distributed along with preprinted forms required for data gathering. For a 4-week period in the first quarter of 1991, laboratory phlebotomists monitored patient identification on inpatients (excluding pediatric patients) at their institutions during their usual daily phlebotomy rounds.

Participants, in addition, provided answers to a series of questions: (1) Who is primarily responsible for performing phlebotomy in your institution? (2) What information is included on the identification band? (3) Are identification bands allowed somewhere else other than the patient's wrist? (4) If identification bands are allowed somewhere else other than the patient's wrist, please designate where. (5) Who is primarily in charge of initially placing an identification band on a patient's wrist? (6) Does your institution have a written protocol for identifying patients at the time of phlebotomy? (7) Is a physician's written order required to remove a wristband in your institution? (8) Are wristband errors continuously monitored by the phlebotomy staff within your institution? (9) If wristband errors are discovered by phlebotomists

Accepted for publication January 20, 1993.

From the Pathology and Laboratory Medicine and Research Services, Veterans Affairs Medical Center West Los Angeles (Dr Renner); Department of Pathology and Laboratory Medicine, University of California at Los Angeles Medical Center (Drs Renner and Howanitz); and Pathology Department, United Hospital, Port Chester, NY (Dr Bachner).

Reprint requests to Laboratory Service, 691/113, Veterans Affairs Medical Center, West Los Angeles, Wilshire & Sawtelle boulevards, Los Angeles, CA 90073.

in your institution, is the nursing service notified in person immediately? (10) If wristband errors are discovered in your institution, is the ward secretary or clerk (or other Medical Administration representative) notified in person immediately? (11) Is phlebotomy refused until the wristband error is corrected? (12) Is correspondence (incident report or memorandum) generated with each discrepancy? (13) If a report is generated, to whom is correspondence sent? (14) Are wristband errors continuously monitored by nursing staff within your institution? (15) If nursing staff continuously monitor wristband errors, how frequently is monitoring performed? (16) Do you use a supplementary (alpha-numeric) wristband for emergency wristband tagging of patients? and (17) Do you use wristbands that incorporate bar-coded patient identification information? The preprinted data collection forms were then mailed to the CAP computer center, data were entered and processed, and statistical information, including percentile rank in relationship to peers, was provided for each participant.⁶

The total error rate (percent) was calculated by dividing the total number of wristband errors by the number of patients monitored for erroneous or missing wristbands before undergoing phlebotomy at each hospital. The error rate was similarly calculated for each type of error, ie, (1) absent wristbands, (2) multiple wristbands with different information, (3) wristbands with incomplete data, (4) wristbands with erroneous data, (5) wristbands with illegible data, and (6) wristbands with a different patient's identification. The institutions were then ranked into percentiles to compare their total error rates and their error rates for each error category (eg, absent wristband or illegible wristband). Those institutions with lower error rates were placed into higher percentiles and vice versa.

The influence that several hospital policies and procedures had on the total error rates was considered. A two-sided *t* test (or *F* test, if there were more than two levels for a factor) of the equality of the mean total error rate was applied (based on the log-transformed total error rate). Significance was defined as probability (*P*) for the two-sided *t* test of less than .05. Linear regression analysis was used to determine a ranking of the importance of various factors in accounting for differences in the total error rate. The contribution of various factors was assessed jointly, using a step-wise procedure to select factors. Factors that were significant by the *t* test or the *F* test but that did not add explanatory power were not included in the regression analysis. Using the standardized regression coefficient estimates, factors were ranked in order of importance. The *R*² for the model was 0.1271.

RESULTS

Data were collected from 712 North American hospitals. Q-Probes participants checked patients for wristband errors on 2 463 727 occasions prior to phlebotomy. Phlebotomists found 67 289 errors in wristband identification; on 33 308 occasions, patient wristbands were missing entirely. The median total error rate was 2.2%. Figure 1 shows the distribution of wristband error rates. Ten percent of participants reported that their total error rate was 10.9% and higher. Seventy percent of participants had error rates less than or equal to the group average of 5.5%.

The proportions of different types of wristband errors, as percentages of total wristband errors, are shown in Fig 2. These percentages were calculated from aggregate raw data, taking into consideration all errors from all participants. The absence of a wristband was by far the most common type of error reported (49.5%; Fig 2). Next, in descending order, were patients wearing more than one wristband containing different information (18.3%), wristbands with incomplete data (17.5%), wristbands with (partly) erroneous data (8.6%), wristbands with illegible data (5.7%), and last, patients wearing wristbands with

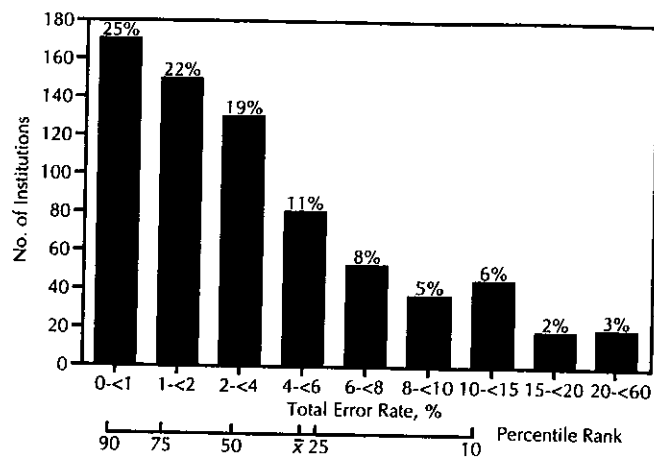


Fig 1.—Distributions of wristband error rates in participating hospitals (*N*=712) where *N* equals number of institutions. Numbers above bars are percents of participants within indicated ranges. Percentile rank of participants indicated by scale below the abscissa, \bar{x} =mean.

another patient's identifying information (wrong wristband) (0.5%).

Figure 3 shows the distribution of different types of wristband errors at various percentiles. There is marked skewing of the distribution of error rates toward lower percentages for all types of errors. The variability of error rates for each error type is also illustrated in Fig 3, with variability being greatest for absent wristbands. The distribution of error rates for several types of errors is close to zero.

Laboratory phlebotomists are the majority (81.2%) of individuals performing phlebotomy routinely in the Q-Probes participants' hospitals. Differences in error rates were independent of who performs phlebotomy. Error rates were also independent of hospital demographic factors, including teaching (an institution with more than two residency programs approved by the Council on Graduate Medical Education) vs nonteaching hospital, bed size, and governmental vs privately owned institution.

Nearly all participants include the patient's name and hospital number on wristbands. A majority also include the patient's sex, location (ward/room number), and birth date on the wristband. Many note the admission date; a few list the home address, race, age, or other identifying information. Differences in total error rates were independent of the kinds of data printed on wristbands or the use of a check-sum number or the use of alpha-numeric wristbands in emergencies (used in 67.4% of hospitals).

Many participants allow alternate placement of identification bands around a patient's ankle (72.7%). Almost a third (30.4%) permit the identification to be placed on the patient's bed, chart, or walls of the patient's room. Fewer participants allow the identification band to be pinned to the patient's clothes (7.4%), taped to his/her body (5.6%), or placed at other locations (2.5%). Designation of an alternate site for an identification band was fifth in importance among factors associated with lower rates of identification errors (*P*=.014).

In the majority of participants' hospitals, wristbands are initially placed by admissions clerks (54.1%). Wristbands are initially placed by nursing staff in many hospitals (41.0%). Ward clerks and others place wristbands in less than 5% of hospitals. The placement of wristbands by nursing staff, admissions clerks, ward secretaries, or oth-

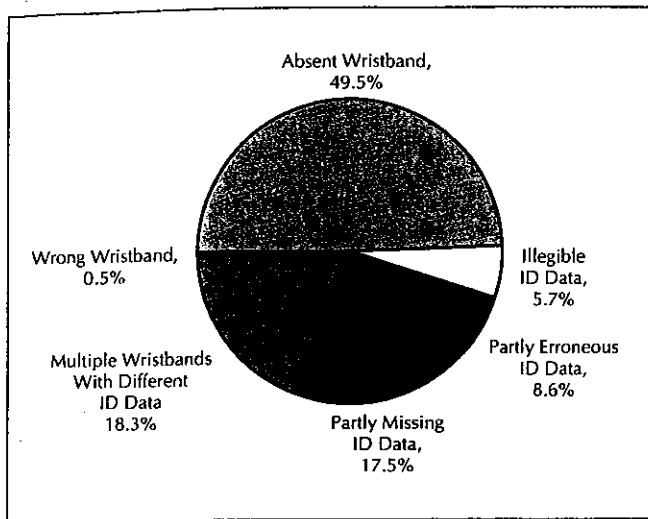


Fig 2.—Proportions of different types of wristband errors as percentages of total errors (includes raw data from all participants). ID indicates identification.

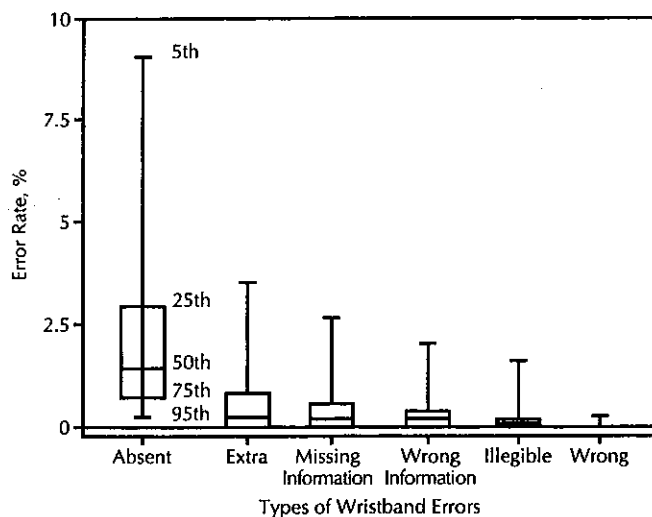


Fig 3.—Box plots comparing the distribution of error rates for different types of wristband errors. Higher percentiles reflect lower error rates and vice versa. The boxes encompass the middle 50% of participating institutions. The median error rate is indicated by a horizontal line within each box. Each arm extending to the top or bottom of each box represents 20% of the participating institutions.

ers, as separately assessed by linear regression analysis, showed significant differences in association with error rates. The placement of wristbands by nursing staff was the one policy that showed an association with increased total error rates (F test; $P < .001$).

Figure 4 shows the relative impact of policies and procedures on error rates. Other policies and procedures, including the use of a written protocol to check identification prior to phlebotomy and the refusal of phlebotomy until wristband errors are corrected, were significant by the *t* test or the *F* test but added no explanatory power to the other factors in the regression analysis.

A majority (61.7%) of the participants' phlebotomy staffs monitor for wristband errors continuously. Monitoring for wristband errors by laboratory phlebotomy staff was the most important factor associated with lower rates of wristband errors ($P < .001$). When monitoring for wrist-

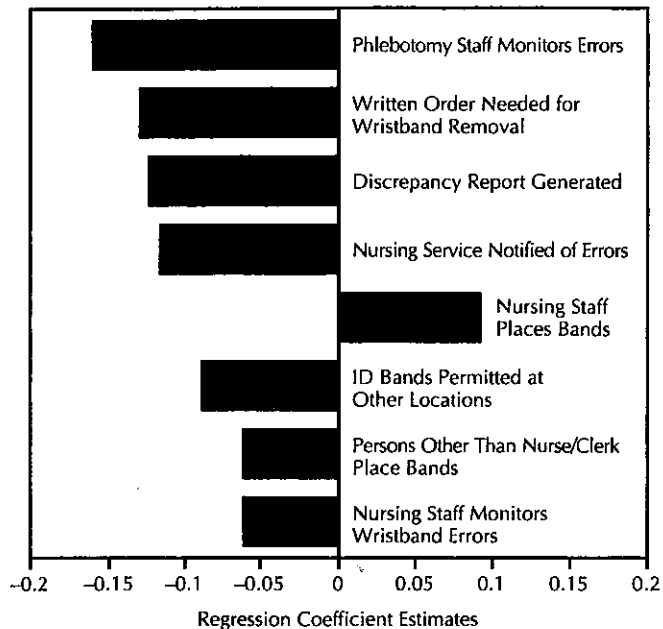


Fig 4.—The relative importance of those factors that had some influence on error rates. The magnitude of each factor's influence is expressed as standardized regression coefficient estimates relative values, indicated by the length of the bar. The direction of the bar, starting at zero, indicates each factor's association with either fewer errors or more errors; to the left of zero are factors that had the effect of lowering error rates; to the right of zero is the single factor (ie, nursing staff places bands) that was associated with increased error rates. ID indicates identification.

band errors was performed by nursing staff (38.9% of hospitals), it was associated with lower error rates, although less strongly so than when monitoring was accomplished by phlebotomists ($P = .006$). The frequency of monitoring for wristband identification errors by nursing staff varied. Of the nursing staffs who perform monitoring, about one fourth (24.2%) check wristbands on every shift, less than one third (31.5%) check on a daily basis, and a little over one fifth (20.5%) check wristbands routinely only prior to transfusion.

Written protocols, used in virtually all hospitals (98.2%) to identify patients at the time of phlebotomy, were associated with lower error rates independent of other factors ($P = .016$). In most hospitals (94.9%), a unique hospital number is given to each patient; some included a check-sum to insure its correctness. In a few hospitals (4.6%), a physician's written order is necessary before a wristband can be removed. A mandatory written order for removal was the second most important policy or procedure associated with lower rates of wristband errors ($P < .001$). Bar-coded information was placed on wristbands in only one participant's hospital.

Almost all phlebotomists immediately notify their hospital's nursing service (90.9%) or a ward clerk/secretary (81.1%) about wristband errors. Notification of nursing staff of errors in person was the fourth most important policy or procedure associated with lower rates of identification errors ($P < .001$). Nearly two thirds (66.5%) of participants refuse phlebotomy until wristband errors are corrected, a practice associated with lower error rates ($P < .001$). Less than one quarter (23.5%) of participants generate an "incident" report with each error, although this factor ranked third in importance in association with lower rates of identification errors ($P < .001$). Sending a

report of errors (presumably compiled into a list) to the nursing service was associated with lower error rates ($P=.044$). Many sent reports to the hospital quality assurance committee, the risk management staff, the admitting office, the ward administration, or to the chief of the medical staff. Error rates were independent of reporting to these latter individuals or groups.

COMMENT

The misidentification of patients, blood specimens, test results, and blood units have long been recognized as major causes of fatal, incompatible transfusions.^{7,8} Taswell, in a recent editorial,⁹ noted that despite many reforms designed to prevent errors in this process, transfusion reactions due to misidentification have persisted at an unchanged rate for several years. The complexity of the blood transfusion process, which includes patient identification, compatibility specimen identification, request form completion, blood product testing, and matching of blood-unit label to patient identification, has thwarted efforts to completely eliminate transfusion reactions.¹⁰ We concur that these reactions will continue until each type of error responsible for transfusion accidents is better defined.

Reports of fatalities alone may not provide enough information about the underlying cause of clerical or "administrative" errors to accomplish their reduction, because of the low incidence of mortality from ABO-incompatible transfusion reactions (currently estimated at one to two deaths per million red blood cell units transfused).^{5,11} Better understanding of the causes of accidents may be gained from the review of all instances of transfusion of blood components to patients other than the intended recipient. Ultimately, in-depth studies of the steps necessary for transfusion must be designed to yield sufficient data on which to base management decisions.

An accounting of transfusion errors reported in New York State between January 1990 and October 1991 showed that only three in 104 misguided transfusions resulted in fatal transfusion reactions.¹¹ The categorization of these 104 cases revealed that 11.5% of errors were due to mislabeled specimens or specimens obtained from the wrong patient. In one instance, an admitting clerk gave the same identification number to two newborn infants. In 43% of errors, there was failure to identify patients prior to transfusion, which resulted in the three reported fatalities. One fatality involved the issue of group B red blood cells to a group O patient with the same last name and first initial as the patient for whom the group B cells were intended.

Basic to the prevention of many transfusion errors, therefore, is the careful examination of a legible, complete, accurate, identification wristband both at the time of phlebotomy and at the time of matching of blood unit label details just prior to infusion. The data presented here reveal that the incidence of missing, incomplete, or incorrect wristband identification is frequent in many institutions. The difficulties with proper wristband identification are numerous: to obtain correct identifying information at the time of admission is sometimes impractical due to the patient's unconscious state or urgent condition.¹² Delay in placing a wristband can occur once a patient is admitted to the hospital, owing to a crush of other responsibilities on nursing and clerical staff. Wristbands are commonly removed to allow access to an arm vein for an intravenous line. Confused or agitated patients may remove wrist-

bands themselves. The wristband print may become smudged when a patient bathes. And the replacement of wristbands requires much effort.

The laboratory phlebotomist can play a valuable role in ensuring proper identification by monitoring the presence and accuracy of patient wristbands on daily hospital phlebotomy rounds. We found that the most important factor associated with lower error rates was the continuous surveillance for wristband identification errors by laboratory phlebotomists. Monitoring for identification by phlebotomists was an established practice in a majority of the study participants' hospitals. Monitoring for wristband errors by nursing staff was also associated with lower error rates, although less strongly so than when accomplished by phlebotomists. The reason for this may be a matter of the frequency of observation. Of the nursing services that monitored regularly, only half checked wristbands daily or more often.

We found that the designation of an alternate site for an identification band (eg, around the ankle) was an important factor associated with low rates of identification errors. This association seems paradoxical, with respect to warnings in the literature regarding the danger of attaching an identification band to the patient's chart, the walls of the patient's room, or to his/her bed.^{4,13} We conclude that, although placement of identification at sites other than the wrist is seldom necessary, the formal designation of an alternate site (ankle) may prevent confusion and error.

Notably, the one factor we tested that showed an association with increased errors was the initial placement of wristbands by nursing staff. Practicality might explain this: wristband placement may be eclipsed by other urgent nursing duties. Absent or incorrect wristbands may not seem, in addition, to pose an immediate difficulty to nursing staff.

Hospitalized patients are known, however, to wander in confusion and return to the wrong bed.¹⁴ Therefore, separation of a patient from his/her identification band, even briefly, invites disaster. Patients must be given a wristband immediately when they enter the hospital, and it must remain intact until they are discharged. Once the wristband is placed, it must be referred to by all care-givers whenever the patient is identified: prior to phlebotomy, prior to the administration of medications, prior to transfusion, and prior to diagnostic procedures, surgery, or other therapy.¹⁵⁻¹⁷

Hospitalized patients who are confused or with impaired hearing may answer to or agree to any name. A standard procedure should be used to identify patients, and it should include matching the name that the patient gives verbally to the wristband identifying information (name, hospital number) and to the information on the patient's test request forms, draw list, or test request summary sheet (in other circumstances, with the medication list, operating room schedule, consultation sheets, or blood request forms).¹⁷

Several mechanisms have been used to attempt to overcome the pitfalls of wristband identification. These include alpha-numeric wristbands for identifying patients by a unique number, which can be placed by the phlebotomist at the time of venipuncture. We believe that these are as likely to be removed as the personalized type. Electronic bar-coded printing, although not assessed in this study because of limited use, promises to eliminate most identification errors.^{18,19} Portable, combination bar-code

scanners/label printers are available to match patients' wristbands and blood units automatically.²⁰

The policies and procedures compared in this study had a modest overall impact on error rates. Awareness of the problem of wristband errors and the elements of management, such as communication, training, and motivation, may determine error rates to a greater degree than do the individual factors explored here. We believe that the following provisional recommendations, however, may improve wristband identification and, potentially, decrease transfusion errors: (1) use a written protocol for patient identification, (2) have phlebotomists check wristbands continuously, (3) notify nursing or administrative staff of wristband errors immediately, (4) delay phlebotomy until wristband errors are corrected, (5) generate an incident report with each wristband error, (6) send periodic reports on wristband errors to the appropriate hospital services and committees, (7) have wristbands placed by admissions personnel, (8) designate the ankle as a standard alternate site for identification band placement, (9) strongly discourage removing identification bands from the patient for any reason especially at the time of surgery, and (10) use the percentile comparisons shown here to develop interim goals and priorities to improve wristband identification within individual institutions.

Statistical review of data was performed by Glenn Good, MS, College of American Pathologists, Northfield, Ill.

References

1. Murphy WG, McClelland DBL. Deceptively low morbidity from failure to practice safe blood transfusion: an analysis of serious blood errors. *Vox Sang*. 1989;57:59-62.
2. Schmidt PJ. Transfusion mortality with special reference to surgical and intensive care facilities. *J Fla Med Assoc*. 1980;67:151-153.
3. Schmidt PJ. The mortality from incompatible transfusion. In: Jamieson GA, Greenwalt TJ, eds. *The Immunobiology of the Erythrocyte*. New York, NY: Alan R Liss Inc; 1980:250-261.
4. Myhre BA, Bove JR, Schmidt PJ. Wrong blood: a needless cause of surgical deaths. *Anesth Analg*. 1981;60:777-778.
5. Szama K. Reports of 355 transfusion-associated deaths: 1976-1985. *Transfusion*. 1990;30:583-590.
6. Howanitz PJ. Quality assurance measurements in departments of pathology and laboratory medicine. *Arch Pathol Lab Med*. 1990;114:1131-1135.
7. Blood transfusion accidents. *BMJ*. 1953;2:390-391.
8. Hall JE, Hellman LM. Transfusion reactions in obstetrics: report of ten cases. *Obstet Gynecol*. 1957;9:250-257.
9. Taswell HF. It's in the bag! (or is it?) *Transfusion*. 1991;31:386-387.
10. Mollison PL, Engelfriet CP, Contreras M. Detection of the reaction between red cell antigens and antibodies. In: Mollison PL, Engelfriet CP, Contreras M, eds. *Blood Transfusion in Clinical Medicine*. Oxford, United Kingdom: Blackwell Scientific Publications; 1987:505-506.
11. Linden JV, Paul B, Dressler KP. A report of 104 transfusion errors in New York State. *Transfusion*. 1992;32:601-606.
12. Claps PJ, Berk WA. The John Doe syndrome: diagnosis and outcome of patients unidentified at the time of emergency department admission. *Am J Emerg Med*. 1992;10:217-218.
13. Myhre BA. Fatalities from blood transfusion. *JAMA*. 1980;244:1333-1335.
14. Cooper E. Kentucky program helps memory-impaired wanderers. *Ky Hosp Mag*. 1991;8:15-18.
15. Cohen MR. Medication errors. *Nurs* 80. 1980;10:17.
16. Carbary LJ, Carbary CN. Positive identification of patients. *J Nurs Care*. 1981;14:18-21.
17. Guy LR. Transfusion patient identification and related problems. *Lab Med*. 1981;12:542-545.
18. Taswell HF, Grosset J, Meine D, DeBusman G. Automation in transfusion practice: storage and retrieval of transfusion information. In: Sibinga CTS, Das PC, Hagman CF, eds. *Automation in Blood Transfusion: Symposium on Blood Transfusion*. Boston, Mass: Kluwer Academic Publishers; 1989:193-200.
19. Tilzer LL, Jones RW. Use of bar code labels on collection tubes for specimen management in the clinical laboratory. *Arch Pathol Lab Med*. 1988;112:1200-1202.
20. Weilert M, Tilzer LL. Putting bar codes to work for improved patient care. *Clin Lab Med*. 1991;11:227-228.

In Other AMA Journals

ADJC

Behavioral Adaptation to Human Immunodeficiency Virus-Seropositive Status in Children and Adolescents With Hemophilia

Stephen R. Hooper, PhD; J. Kenneth Whitt, PhD; Michael Tennison, MD; Margaret Burchinal, PhD; Stuart Gold, MD; Colin Hall, MD
(*AJDC*. 1993;147:541-545)

The Value of Urinary Growth Hormone Determination for Assessment of Growth Hormone Deficiency and Compliance With Growth Hormone Therapy

Moshe Phillip, MD; Stuart A. Chalew, MD; Mark A. Stene, PhD; A. Avinoam Kowarski, MD (*AJDC*. 1993;147:553-557)