

Point-of-care Testing: A Step to the Future

By Thomas J. Dilts, MT(ASCP), MBPA

Mr. Dilts describes here his experiences while he was Administrative Director of Laboratory Services at Baptist Medical Center in Jacksonville, Florida. He recently became Director of Laboratory Services at Medical College of Virginia, in Richmond.

The healthcare environment is changing so rapidly, we all have to run at top speed just to keep up. Change is the norm, and anyone seeking to maintain the status quo should not be in or go into health care as a profession. The change process shows no sign of slowing down. In fact, all aspects of this field are moving equally fast: technology, automation, robotics, informatics, economics, etc. It is no wonder that point-of-care testing (POCT) is moving rapidly ahead as one of the major approaches to solving what seems to be the major challenge: how to do more with less. POCT is not the answer to every question, but may be the only reasonable answer to some questions in laboratory medicine.

Paradigm Shifts

Historically, laboratory testing has been performed in a central laboratory by laboratorians. In addition, some testing has been performed in "satellite" laboratories separate from the central laboratory-but still by laboratorians. If you look at this model and compare it to POCT, you have a good example of a paradigm shift. POCT is performed close to or at the patient's location-and often by nonlaboratorians. This is clearly a different model from the historic central laboratory.

As with any change, most people at first resist POCT. This attitude has significantly changed in the last few years, but there still are those who would rather ignore it than consider it. You need to manage POCT, not resist it. Maintaining the status quo is not a strategy for survival in laboratory medicine today. Nor will it suffice for the future.

Why Consider POCT?

A major mission of clinical laboratories is to provide high-quality, efficient, timely laboratory testing to the healthcare community at a reasonable cost. Each time we need to provide laboratory support we need to consider quality, service and cost-usually in that order. With the additional pressure that economics has created in health care today (managed care, Medicare, capitation), it can become a real challenge to meet these three criteria to accomplish your mission. POCT can be an opportunity to achieve this, by providing a stimulus for managers to rethink how they provide laboratory services. It can motivate us to look at things in a different light.

Let me share with you some experiences we had at Baptist Medical Center in Jacksonville, Florida, in meeting our patient care needs. In the first two examples it turned out that POCT was not the only answer. In the last two examples, it was the answer.

The Adult Operating Room

Staff of the Adult Operating Room (OR) wanted faster turnaround times (TATs) for electrolytes and hematocrit on adult open heart cases. Our TAT was 15 minutes, but they wanted less than 10 minutes. The perfusionist was drawing the specimen in the OR and having it walked over to the laboratory by an OR transporter. One specimen went to Hematology for the hemoglobin and hematocrit (H&H), and one specimen went to Chemistry for the electrolytes. At the same time these specimens were drawn in the OR, a blood gas specimen was drawn and the same OR transporter walked it up to the fourth floor to the Blood Gas Laboratory operated by the Pulmonary Department. Sometimes the transporter went to the Clinical Laboratory first, and sometimes to the Blood Gas Laboratory first. The chemistry specimen was centrifuged and the electrolytes performed on the EKTACHEM 700 analyzer. The results were telephoned to the OR from all three locations.

We needed to break down the turnaround time, to see where the time was being spent. We broke down the TAT into seven steps: request, collection, transport, processing, analysis, reporting, and therapeutic action. This was the therapeutic turnaround time (T-TAT): from the time of the request to the time when therapeutic or patient management action was taken. We then looked at the time it took for each step. We found that time for the verbal request (which would be entered into the computer after analysis), collection, transport (with the OR close to the laboratory), and reporting averaged about 9 minutes. The remainder of the TAT was spent in spinning the specimen down and performing the analysis. We knew we had to look at all the steps of the T-TAT-those steps occurring outside the laboratory as well as inside the laboratory-to significantly reduce the TAT.

POCT was not a good option from a resource point of view, because Florida law at that time did not allow a perfusionist to perform electrolyte testing. If we did put a POCT instrument in the OR, someone from the laboratory staff with a state license in medical technology would have to run the tests. The volume of work was not enough to make this efficient and cost-effective, although it would have resulted in a TAT of less than 10 minutes.

We decided to use a NOVA whole-blood analyzer we already had in the chemistry department, to eliminate the processing (centrifugation) of the specimen. We met several times with the OR staff to discuss the activities of the plan. We were able to reduce the transport and reporting times by convincing the OR and the Pulmonary Department that we should do the electrolytes and hematocrit tests on one specimen in one location. (The NOVA analyzer was relocated to the front of the laboratory in Specimen Management, where the specimen first enters the department.) We also decided that the transporter would wait for the results that came from the instrument, so a hard copy could be returned immediately to the OR.

Our average turnaround time for the OR on the NOVA analyzer from collection to result became 7 minutes, down from an average of 15 minutes before we made the changes. By utilizing an existing whole-blood instrument that could do all the procedures needed, not adding any personnel, and performing the testing in the main laboratory, we were able to meet the clinical needs of the OR in a very cost-effective and efficient manner. A POCT approach was not needed.

The Emergency Room

The first thing we did was an onsite observation of the Emergency Room (ER) and how its system worked. We found that when a nurse was triaging a patient, she often knew what laboratory work was needed as soon as 15 to 20 minutes before the physician saw the patient. As much as 50% of all blood drawn in the ER was taken by a nurse when starting an IV. Once physicians examined the patients, they knew what laboratory work they wanted, but may not have ordered it until they left the room and wrote their clinical findings in the patients' charts. The TAT for laboratory work seemed to start in the mind of the physician when he or she decided what laboratory work was needed. It may not have been ordered, however, until 15 to 30 minutes after this.

When we looked at the TAT for the ER, we found that:

- Complete blood cell count (CBC) with autodifferential took 38 minutes, and the chem 7 profile took 52 minutes. Both were measured from collection to reported result.
- Urinalysis took 33 minutes, urinary chorionic gonadotropin (UCG) took 23 minutes, and a Strep screen took 30 minutes from login in the laboratory to report of the results. (We could not control the specimen collection and we received very few collection times for the specimens from the ER staff, so we measured the TAT as starting when the laboratory received the specimen.)

When we looked at the seven steps for the T-TAT for the two highest-volume laboratory procedures in the ER (chem 7 and CBC) we found that for the chem 7, about 50% of the time was spent on those steps outside of the laboratory (request, collection, transport), and for the CBC, about 60%.

We knew the in-laboratory time could be significantly reduced by using the whole-blood analyzer in the main laboratory and prioritizing the ER CBCs in Hematology. We then concentrated on reducing the time

for the steps of the T-TAT occurring outside of the laboratory. A team approach was used, with laboratory and ER staffs working together. We put a new profile into the computer menu that allowed quick ordering of a whole-blood chemistry profile and CBC in one step. The ER staff started to order the laboratory work before they started to write the patient chart; the specimens were either sent through the pneumatic tube system or walked to the laboratory (about 300 feet away); whole blood was used for the analysis, and results were reported on the computer system to the ER. We gave inservice training to all shifts of the ER staff on the use of the new ER whole-blood profile (CBC with autodifferential, sodium, potassium, chloride, carbon dioxide, glucose, blood urea nitrogen).

We also reduced our in-laboratory TAT for the urinalysis (using a YELLOW IRIS automated urinalysis instrument), qualitative pregnancy test, and Strep screen by having these performed as soon as they came into the laboratory. The laboratory staff had been functioning on the basis of getting the results back within 1 hour.

Once we initiated these changes our TATs for the ER changed as follows: CBC-reduced from 38 minutes to 15 minutes (collection to result); chemistry profile (glucose, blood urea nitrogen, sodium, potassium, chloride, carbon dioxide)-reduced from 52 minutes to 14 minutes (collection to result); Strep screen*-reduced from 30 minutes to 15 minutes (login to result); urinalysis*- reduced from 33 minutes to 11 minutes (login to result); and pregnancy test*-reduced from 23 minutes to 13 minutes (login to result). Because of this, the ER physicians usually receive their results before they finish writing the patients' charts. Their perception is that the turnaround time has greatly improved and meets their clinical needs.

The Pediatric OR

Once it was announced that we would start a Pediatric Cardiovascular (CV) Program at the Wolfson Children's Hospital, the laboratory had to figure out how to provide the needed laboratory support. Since the Pediatric OR was on the other side of the campus, and a 5-minute or shorter TAT was required for testing blood gases, electrolytes, and ionized calcium, we strongly considered a POCT program.

In coordination with the Pediatric Cardiovascular Committee, we decided to place a NOVA ULTRA whole-blood analyzer in the OR with a remote automated laboratory system (RALS). This setup would allow the perfusionist in the OR to perform all the needed procedures, and the RALS would transmit the results back to a computer screen in the central laboratory, so that a medical technologist could review the quality control, patient results, and instrument status if necessary.

This setup resulted in a 4-minute TAT and was more cost-effective than other approaches we considered. No additional personnel were needed and the cost per test was lower than with other POCT instruments.

The Pediatric Intensive Care Unit (PICU)

As part of the pediatric CV program, it was necessary to follow the patient after surgery with the same laboratory procedures as in the OR. There already was a Blood Gas Laboratory operated by the Pulmonary Department in the PICU. The state laboratory regulations had been revised to allow nonlaboratorians to perform POCT, including moderately complex testing, if approved by the medical director of the laboratory. We collaborated with the Pulmonary Department and placed a NOVA ULTRA whole-blood analyzer with RALS in the PICU Blood Gas Laboratory. The RALS allowed the pulmonary technologist to perform procedures other than blood gases on the NOVA. Then a medical technologist in the Central Laboratory could verify the results via a computer screen and release them to PICU. The RALS allowed the Central Laboratory to coordinate the POCT program.

This setup has proved successful for the pediatric OR and PICU. It was installed recently in the Neonatal Intensive Care Unit (NICU) and may be extended to the Adult Intensive Care Units (ICUs). This will be a proactive approach to providing needed clinical laboratory support, since the future trend will be for ICUs to require increasingly sophisticated testing with rapid TAT.

The Future

As with other technologies, POCT is continually evolving. We expect to see increased utilization of this approach, as follows:

1. More systems like the RALS will be developed, allowing very sophisticated laboratory instruments to be used out of the laboratory but linked to the laboratory via a computer system. Instead of a medical technologist releasing the results, a computer will release results and signal a medical technologist only when something goes wrong. Automated and computerized satellite laboratories using a RALS-type program will come into use, so that many healthcare workers can present a whole-blood specimen to the instrument(s) and receive results in less than 5 minutes.
2. Home testing kits will increase in diversity and volume. Glucose, HIV, cholesterol, and other home testing kits are now sold without prescription at retail stores. In the future, most routine hematology, coagulation and chemistry test kits will be available.
3. There will be routine use of continuous monitoring of various analytes in many ICUs, by arterial and venous catheter links to a computer.
4. Noninvasive testing will become commonplace. We presently have these procedures for oxygen and bilirubin. There will be noninvasive testing for all blood gases, electrolytes, and other routine chemistries in the future.

Discussion

We were able to meet the needs of both the OR and the ER in the centralized laboratory, without shifting to POCT. Much of the analysis and system development, however, was stimulated by our knowledge and awareness of POCT.

We knew POCT would accomplish the same outcome, but could we do it more cost-effectively in another way and still meet the clinical needs? In other cases the POCT approach made the most sense.

Laboratory medicine, like all of health care, is a very dynamic, rapidly changing environment. As the standard of care changes, as state and federal laws change, as technology develops, and as the economics of health care continue to change, we will be challenged to find new ways to fulfill our mission and goals. Once global budget concepts are applied, the economic benefits of POCT are proven, and it meets the clinical needs of the standard of care, we will be using this approach more and more. By understanding and considering POCT, you may become aware of other ways to meet the needs of your medical facility.

Editorial Commentary

The medical laboratory field is being changed forever by the advent of point-of-care testing (POCT). "You need to manage POCT, not resist it," says Thomas Dilts in "Point-of-Care Testing: A Step to the Future." He shares with us some experiences in evaluating the use of POCT for different patient care needs. To compliment this article, LAB NOTES has assembled a brief sampling of opinions on POCT, for your review .

Hepatitis C is responsible for an estimated 8,000-10,000 deaths annually, and is now the leading reason for liver transplantation in the United States. In "A New Consensus on Hepatitis C," we bring you the latest assessment of this disease, as developed by a consensus panel during a conference that was sponsored by the National Institute of Health.

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Editor

A New Consensus on Hepatitis C

The National Institute of Diabetes and Digestive and Kidney Diseases and the Office of Medical Applications of Research of the National Institutes of Health (NIH) - along with cosponsors the National Institute of Allergy and Infectious Diseases; National Heart, Lung, and Blood Institute; National Institute on Drug Abuse, and the Centers for Disease Control and Prevention - sponsored a Consensus Development Conference on Management of Hepatitis C in Bethesda, Md. Following a day and a half of testimony by 25 experts in the relevant fields and discussion from members of the audience of 1,600, a consensus panel representing general internal medicine, hepatology, gastroenterology, infectious diseases, medical ethics, transfusion medicine, epidemiology, biostatistics, and the public considered the evidence and formulated a consensus statement.

The panel's objective was to provide healthcare providers, patients, and the general public with a responsible assessment of current available methods to diagnose, treat and manage hepatitis C. Presented here for LAB NOTES readers is a summary of the conclusions and recommendations issued by the 12-member consensus panel, with a few excerpts from the background information the group produced.

Introduction

Currently, hepatitis C is responsible for an estimated 8,000-10,000 deaths annually, and without effective intervention that number is postulated to triple in the next 10 to 20 years. Hepatitis C is now the leading reason for liver transplantation in the United States.

Hepatitis C is transmitted primarily by the parenteral route, and sources of infection include injection drug use, needlestick accidents, and transfusions of blood or blood products. Since 1990 and the introduction of tests for antibodies to the hepatitis C virus (anti-HCV), new cases of posttransfusion hepatitis C have virtually disappeared.

Direct percutaneous exposure is the most efficient method for transmitting HCV, and there is some evidence for occupational and nosocomial transmission of HCV infection. Healthcare workers have a higher prevalence than the general population, although many may have acquired it from other sources. However, inadvertent needlestick injuries and lack of application of universal precautions may be contributing factors.

The risk of infection from needlesticks in hepatitis C is intermediate between that of human immunodeficiency virus (HIV) and hepatitis B. HCV transmission between patients in dialysis centers may be related to poor infection control practices. Although transmission from healthcare workers to patients has been documented, such transmission is thought to be rare.

Hepatitis C virus is not easily cleared by the host's immunologic defenses. Thus, a persistent infection develops in perhaps as many as 85 percent of patients with acute hepatitis C. This inability of the infected host to clear the virus sets the stage for the development of chronic liver disease. And in contrast to hepatitis A and B, there is no effective vaccine to prevent acquisition of hepatitis C infection.

Among The Panel's Conclusions

Individuals who have a history of transfusions of blood or blood products prior to 1990, who are on chronic hemodialysis, who have a history of injection drug use, who have had multiple sexual partners, who are the spouses or close household contacts of hepatitis C patients, and who share instruments for intranasal cocaine use should be tested for HCV.

Hepatitis C is a common infection with variable course that can lead to chronic hepatitis, cirrhosis, liver failure, and hepatocellular carcinoma. The course of illness may be adversely affected by various factors, especially alcohol consumption. Therefore, more than one alcoholic drink per day is strongly discouraged in patients with hepatitis C, and abstinence from alcohol is recommended.

An enzyme immunoassay (EIA) test for anti-HCV should be the initial test for diagnosis of hepatitis C. In low-risk populations, a supplemental recombinant immunoblot assay (RIBA) test and/or a qualitative polymerase chain reaction (PCR) test for HCV ribonucleic acid (RNA) should be performed in those whose EIA test is positive. In patients with clinical findings of liver disease, HCV RNA by PCR can be used for confirmation.

Because of assay variability, qualitative and quantitative PCR testing for HCV RNA must be interpreted cautiously. Rigorous proficiency testing is recommended for clinical laboratories performing this assay. The branched deoxyribonucleic acid (DNA) signal amplification assay for viral level has been standardized, but may fail to detect low titers of HCV RNA. Sequential measurement of HCV RNA levels (viral load) has not, to date, proven useful in managing patients with hepatitis C.

Liver biopsy is indicated when histologic findings will assist decision making regarding patient management. In patients who are not treated with antiviral therapy initially, liver biopsy can be considered, to assess disease progression.

HCV genotyping and tests for HCV RNA levels (viral load) may provide useful prognostic information, especially regarding response to therapy, but at present must be considered research tools. Currently available therapy for chronic hepatitis C is indicated for patients who have persistently (longer than 6 months) abnormal alanine aminotransferase (ALT), a positive HCV RNA, and liver biopsy demonstrating either portal or bridging fibrosis and at least moderate degrees of inflammation and necrosis. Patients with milder histological disease, compensated cirrhosis, or who are under age 18 or over 60, should be managed on an individual basis or in the context of clinical trials. Patients with decompensated cirrhosis should not be treated with interferon but should be considered for liver transplantation.

Because 12-month regimens with interferon are more successful in achieving sustained responses, initial therapy with interferon alfa (or its equivalent) should be 3 million units subcutaneously, three times weekly for 12 months.

Nonresponders to interferon should not be treated again with the same regimen, but should be considered for combination therapy or enrollment in investigational protocols.

Hepatitis A and B vaccination is recommended for all HCV-positive patients.

Panel Recommendations to Reduce HCV Transmission

In healthcare settings, adherence to Universal (standard) Precautions for the protection of medical personnel and patients is essential.

HCV-positive individuals should refrain from donating blood, organs, tissues or semen. In some emergency situations, the use of organs and tissues from HCV-positive individuals may be considered. Prospective blood donors with any prior history of injection drug use must be deferred from donating blood.

Safer sexual practices should be strongly encouraged in persons with multiple sexual partners, including the use of latex condoms. In monogamous long-term relationships, transmission is rare. It is recommended that sexual partners of infected patients should be tested for antibody to HCV.

In households with an HCV-positive member, sharing razors and toothbrushes should be avoided, and covering open wounds is recommended. It is not necessary to avoid close contact with family members or to avoid sharing meals or utensils. There is no evidence to justify exclusion of HCV-positive children or adults from social, educational and employment activities.

Pregnancy is not contraindicated in HCV-positive individuals. Perinatal transmission from mother to baby occurs in less than 6 percent of instances, and there is no evidence that breast feeding transmits HCV from mother to baby. Babies born to HCV-positive mothers should be tested for anti-HCV at 1 year. Needle exchange and other safer injection drug use programs may be of benefit in reducing parenterally transmitted diseases. Expansion of such programs should be considered, in an effort to reduce the rate of transmission of hepatitis C.

For the future, much research on HCV is needed. And although continued education of risk groups and screening of blood, organs, tissue and semen remain vitally important, the key to prevention is development of an effective and safe vaccine for hepatitis C. This will require a better understanding of the molecular determinants of both cellular and humoral immunity to HCV, the nature of antigenic variation as related to viral quasispecies diversity, and the mechanism(s) by which HCV regularly eludes the host immune system and establishes persistent infection.

Source: NIH Consensus Statement, March 24-26, 1997; 15(3): in press; online version, May 7, 1997. The statement is an independent report of the consensus panel and is not a policy statement of the NIH or the federal government.

POCT: Some Pros, Cons, and Thoughts on Costs

To complement this issue's lead article on point-of-care testing (POCT), LAB NOTES searched the literature and assembled the following brief sampling of opinions on POCT-showing how studies and various institutions' experiences reveal the range of considerations involved in dealing with this important trend. The cited items can provide you with a useful list of additional readings on the topic.

In predicting how POCT will affect the medical technologist, one lab director in Indianapolis said he believes the "role will change and expand to be teacher, overseer and quality control person" and eliminate from it the "mundane testing....We will be able to do more esoteric testing. The challenge in the main lab will be the more complex tests; the challenge on the floor is working with people."¹

The director of the Office of Laboratory Evaluation at the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) said her perspective is that "Many laboratorians are feeling less in control of their job future than ever before," but that POCT technologies "may be the answer to keeping talented individuals within the laboratory profession by providing an outlet for their knowledge through cross-training or merging with other health care professionals."²

An extensive, thorough set of guidelines to consider in planning for the kind of POCT that will improve patient outcomes has been assembled by the Medical Pathology Department of the School of Medicine at the University of California, Davis.³ The author writes that "Rising expectations, patient-focused hospitals, and managed care intensify the need for immediate decisions at the point of care."

In all POCT planning, regulatory and accreditation requirements must be considered. An overview article emphasizes that the Clinical Laboratory Improvement Amendments of 1988 (CLIA'88) state that "all testing is site neutral, therefore the same regulations apply regardless of where the test is performed. All POCT programs must apply for a CLIA certificate and choose an appropriate accreditation agency for their needs."⁴

In discussing POC thrombosis and hemostasis testing, one author stressed that "Although the role of the pathologist/laboratorian is central, the key to a successful POC program is the assumption of responsibility for the test result by the laboratory, test orderer, and test performer."⁵

POCT cost-effectiveness studies display a great diversity of conclusions. One intensive-care physician notes that "to establish POCT as a cost-effective program, outcomes must be measured, including rates of morbidity, mortality, and efficiency, in addition to calculations of cost and revenues."⁶

A paper from the University of Texas Southwestern Medical Center in Dallas gives a thorough review of factors affecting economic considerations and cautions that conditions vary widely among institutions, so that POCT study results "cannot be generalized to other settings."⁷

An economic analysis at Thomas Jefferson University Hospital in Philadelphia found that "From a clinical management perspective, patient consumer issues such as expectations for timely and efficient health services delivery and earlier physician decisions on course of care suggest that selective use of POC testing in the emergency department can result in long-standing cost savings to the hospital."⁸

At Memorial Sloan-Kettering Cancer Center in New York, a comparison of whole blood and serum analytes testing at a centralized urgent care lab (with a modern pneumatic specimen delivery system) versus a POC satellite lab revealed that the central lab provided comparable turnaround times, lower costs, and greater test reliability. The authors cautioned that "Rapid, more expensive, less accurate testing, whether at the bedside or in the central laboratory, is unacceptable and will not withstand the increased scrutiny of quality assurance and accrediting agencies."⁹

A large study of bedside capillary glucose testing at Massachusetts General Hospital in Boston found that bedside costs were comparable to central lab testing, except that "implementation on inefficient care units with low utilization can add substantially to the cost."¹⁰

A comparison of POC glucose and chemistry panel tests with central lab stat testing in a 204-bed community hospital in Ithaca, NY, showed POCT costs to be 1.1 to 4.6 times higher, and "the more POCT is used, the greater the excess costs compared to the central laboratory."¹¹ In this hospital, "the investment in acquiring automated transport and data management systems...was far less expensive than POCT for both an individual stat test and on an annual cost basis."

Another study, at a hospital affiliated with Washington University School of Medicine in St. Louis, found that a hand-held instrument for chemistry-panel POCT "demonstrated acceptable accuracy" but did not reduce patients' length of stay in the Emergency Department.¹²

But at Methodist Hospital in Indianapolis, initiating POCT for blood analysis substantially reduced costs and turnaround time, with laboratory staff reductions through attrition and redeployment.¹³ The switch was deemed successful because "patients and families see their care impacted by the availability of information in real time."

At a POCT conference of 225 healthcare professionals in Philadelphia, sponsored by the National Academy of Clinical Biochemistry and several other groups, the "notion that 'faster is better' became a point of contention."¹⁴

It was determined that research and standardization are needed, to develop an algorithm for evaluating clinical and economic outcomes that can show when POCT is the best choice for patient care, and when "faster may just be faster and not better."

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Medical Lore

The History of Becton Dickinson - Part 2

The end of Part 1 of this brief history of Becton Dickinson and Company (Volume 7, Number 2) related how Maxwell W. Becton and Fairleigh S. Dickinson, Sr., had met as young traveling salesmen in Texas and decided to go into business together. In 1897 they established their firm at 45 Vesey Street in Manhattan, importing and selling fever thermometers from Hicks in England and syringes from Luer in France. Their first sale, on October 8, was for one Luer all-glass syringe, priced at \$2.50. But they soon became frustrated by the inability to control shipping dates and by the amount of product broken in transit, so they bought the U.S. patent rights and began manufacturing their goods in this country. They built their own factory in East Rutherford, NJ, in 1906 - the first manufacturing facility in this country created specifically to produce thermometers, hypodermic needles and syringes. Now, in 1998, the company still is headquartered in the same Bergen County, just a few miles northwest, in Franklin Lakes, NJ. But it has grown to include more than 18,000 employees in approximately 40 nations.

The following highlights just a few major milestones in the development of products that have led to BD's present status as the world's largest supplier of disposable hypodermic products and one of the world's largest medical technology companies.

1918: Because World War I had cut off imports of Benda's Ideal Bandage from Germany, BD's Oscar O.R. Schwidetsky developed the techniques to manufacture an all-American equivalent. A contest for physicians awarded a \$200 prize for the best name for the new product. The winner was the acronym "ACE" - for "all cotton elastic" - and the ACE® Bandage was born.

1921: Andrew W. "Doc" Fleischer, developer of the mercury sphygmomanometer for measuring blood pressure, merged his company with BD, then spent his career developing and refining medical instruments, including the modern stethoscope.

1924: BD manufactured its first syringe - all glass, with etched dual-scale measurement lines - designed specifically for insulin injection, marking the start of the company's commitment to diabetes care.

1925: Fairleigh Dickinson was issued a patent for the LUER-LOK® Tip, an innovation that securely attached the hypodermic needle to the syringe.

1937: Joseph J. Kleiner invented the Evacutainer device, which drew blood by vacuum through a needle into a test tube. Although he tried immediately to interest BD in his invention, it wasn't until after the company hired him in 1943 (on the basis of his MULTIFIT® Syringe with interchangeable parts) that the tube was manufactured, renamed with the new VACUTAINER® Brand. It soon became the company's biggest-selling item.

1948: The founders' sons, Fairleigh S. Dickinson, Jr., and Henry B. Becton, assumed leadership of the company for the next generation.

1950: Tubes containing EDTA as an additive were introduced, and packaging of VACUTAINER® Tubes was changed from cartons to vacuum cans, to prolong shelf life.

1952: BD delivered to the American Red Cross 250,000 units of its newest innovation - sterile, disposable blood donor kits (shown on this page) - for field use in the Korean War.

1954: Racing to meet what seemed an impossible deadline, BD produced millions of syringes and needles (at cost) and delivered them to 215 test sites in 44 states, so that the first large-scale trial of the Salk polio vaccine could take place in the spring, in time to protect children against the summer onslaught of the disease.

1961: The PLASTIPAK® Disposable Plastic Syringe was introduced.

1964: Product introductions this year included small-volume tubes; thin-wall needles; small-volume, single-use holder/needle combinations, and the VACUTAINER® Brand Needle Adapter.

1969: Butyl tube stoppers that prolonged vacuum retention allowed conversion back to carton packaging of tubes.

1973: Through a licensing arrangement with Stanford University, BD built the first two FACS® (fluorescent activated cell sorter) instruments, one for Stanford and the other for the National Institutes of Health. These revolutionary machines could sort, stain, size and count thousands of cells every few seconds, providing major advances in medical research and patient care, and setting B-D on the path that has made it today's worldwide leader in flow cytometry equipment.

1975: The SST® Tube was introduced and a patent was issued for the HYPAK® Prefilled Syringe containing heparin.

1987: MICROTAINER® Safety Flow Lancets were brought to market.

1989: The HEMOGARD® Closure was introduced, on VACUTAINER® and SST® Tubes.

1991: VACUTAINER® Brand PLUS Tubes were introduced, for greater safety and improved disposal.

1997: BD celebrated its centennial.

Thorough Education in Blood Collection Now Available

Blood collection, handling and specimen transportation have changed markedly over the past decade, with increased awareness of the risk of bloodborne pathogens and in response to a changing healthcare delivery system. These changes call for new educational approaches and materials. Regardless of when and where phlebotomists, nurses and other healthcare professionals first learned blood collection techniques and protocols, in actual practice they find themselves facing new situations, unanticipated responsibilities, a more diverse range of locations where blood must be collected, higher volumes of testing, and more risk to themselves and their patients.

The Blood Collection Education Program recently introduced by the Becton Dickinson Vacutainer Safety InstituteSM is contained in an on-site study kit that gives healthcare workers the information and techniques they need, to protect themselves and their patients while drawing, handling and transporting blood specimens in today's healthcare environment.

The Blood Collection Education Program is unique because it covers practice and safety issues across a wide array of blood collection techniques. Before its arrival, individuals and institutions had to go to several different sources for information on collection, handling and transportation of blood specimens. But this kit offers an integrated, comprehensive program covering all three of these fields. It includes complete instruction in topics from routine venipuncture, through difficult draws, to infection control.

Designed by Kathleen Becan-McBride, EdD, MT (ASCP), for use either in a classroom situation or by an individual healthcare worker, the Blood Collection Education Program encourages participants to learn by viewing, practicing and reading.

Dr. Becan-McBride, who was the guest editor of LAB NOTES Vol 7, No 2, noted that although many groups of healthcare workers are being given new responsibilities for blood collection, handling and transportation, they may not always be given adequate preparation for these tasks. This program can help them learn the skills they need.

The program contains six videos (each approximately 20 minutes long), a kit of safety products for hands-on training, the most recent edition of *The Phlebotomy Handbook* (on which the program is based), and other written materials. In addition, numerous "reminder" materials such as wall charts, pocket cards, and stickers help reinforce the learned material and spread the information throughout the workplace.

When the program is offered as a group course, the instructor's guide, classroom materials, sign-up sheets and examination questions make it easy to implement. Individual learners also find the sequence easy to use, because the six videos were designed in sequence, with a narrator who demonstrates various techniques.

The videos are:

- Modern Blood Collection Techniques, Vol. 3
- Modern Blood Collection Techniques for Nurses, Vol. 1
- Blood Collection: The Difficult Draw
- Blood Specimens: Transportation and Handling
- Blood Specimen Collection: Troubleshooting and Helpful Hints
- Blood Specimen Collection: Microcollection Techniques, Vol. 4

The Blood Collection Education Program has been approved for continuing education credits by the National League for Nursing. CE credits (4 contact hours) are available after completing the entire program and meeting the requirements of the NLN. Instructions for obtaining the CE credits are included in the program kit.

To order the complete Blood Collection Education Program, or individual videos from the program, call 1-800-ALL-MEDIA or contact your VACUTAINER Systems sales representative.