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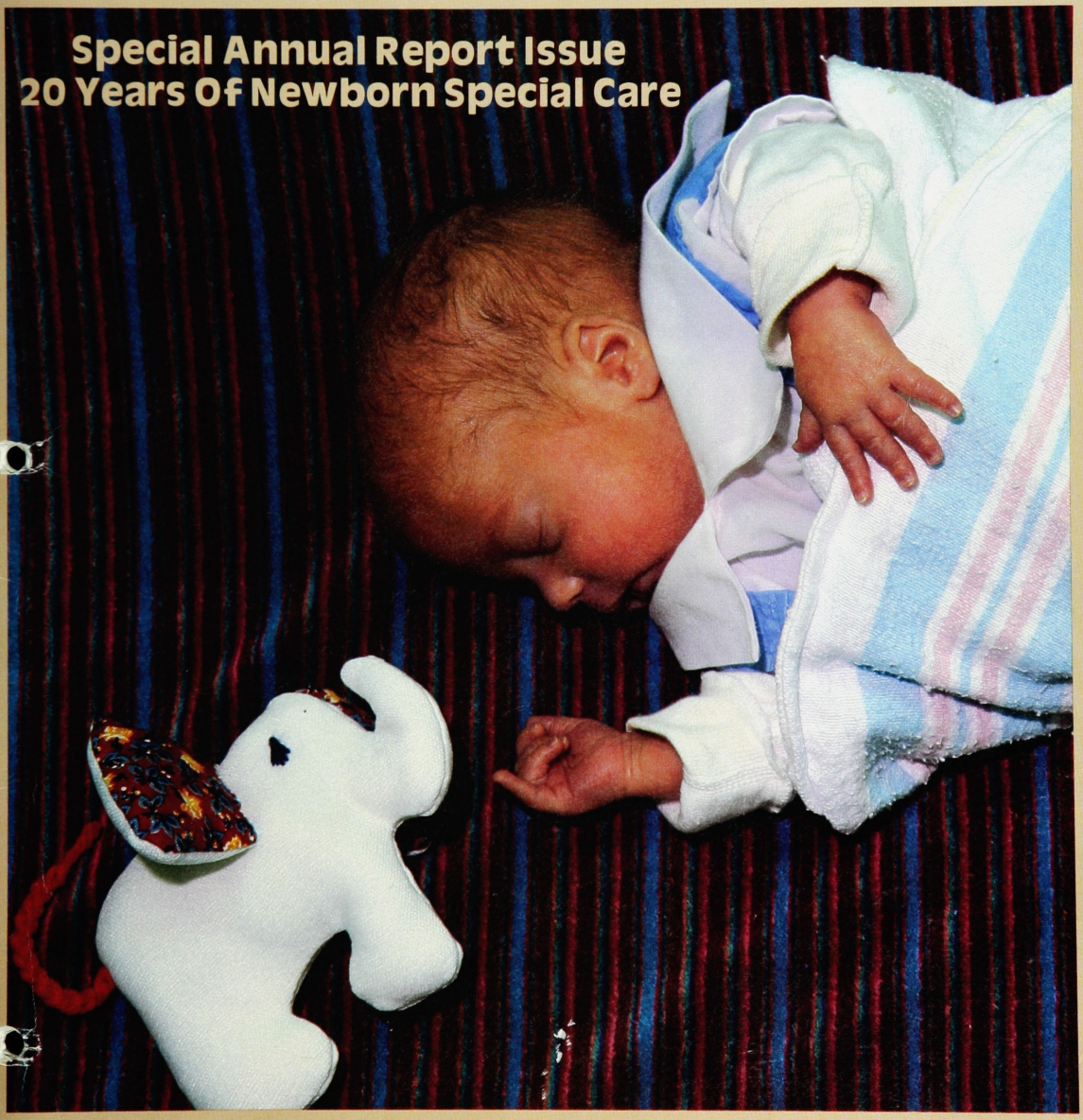
Yale-New Haven Special Annual Report Issue (1980 - 1981)

Yale-New Haven Hospital

YaleNewHaven

Winter 1980-81

Special Annual Report Issue
20 Years Of Newborn Special Care



From The President

This year's Annual Report focuses on a program of which all members of the Yale-New Haven Hospital family can be especially proud — care of the newborn. Yale-New Haven Hospital has the largest maternity and newborn service in the State of Connecticut, with approximately one out of every eight births occurring here. Much developmental work has been done over the years to provide, in this institution, one of the most advanced services available in the United States.

The creation of the Newborn Special Care Unit at Yale-New Haven 20 years ago was an example of the kind of progress that can be made in a medical center environment. The unique skills and resources available in this setting fostered the development, with the generous support of the Dana Foundation, of a program that has served as a model for the country. In light of our current fund raising campaign for the new building, this underscores the importance of private donor support in providing the financial wherewithal for significant programs that can be implemented in this Hospital because of the unique caliber of our staff.

In these days of cost awareness, one has to ask the hard question as to whether it is worth it. Services such as those provided in the Newborn Special Care Unit cost an excessive amount of money. It is not unusual for costs ranging from $10,000 to $30,000 to be incurred over several months for care rendered to an infant with multiple medical problems. Clearly, testimony can be given by the parents of these children that such costs are indeed worthwhile. Only by seeing the joy that a child brings can one appreciate how much this service means.

As the following articles point out, however, there is a limit to the impact of medical technology. Amazing things can be and are being done to assure that problem pregnancies are successful and that problems of the newborn are corrected. Much more needs to be done, however, to try to prevent the problems in the first place. A variety of environmental, social and educational circumstances lead to physical maladies which medicine can correct, but which, more appropriately, should be prevented before they develop.

We are proud to highlight this important area of our institution and hope you enjoy learning more about it.

Tom Smith

C. Thomas Smith

YaleNewHaven

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20 YEARS OF NEWBORN SPECIAL CARE

It is with great pride that we depart from tradition and devote this entire Annual Report issue of *Yale-New Haven* magazine to the story of special care for the newborn. The articles range from a discussion of the high-risk mother herself to the social workers who help families cope with the shattering emotions surrounding the birth, or death, of an infant with special problems.

Given the many little miracles that are performed daily in the nation's Newborn Special Care Units, it is easy to forget how recent the whole notion of newborn special care really is.

This year Yale-New Haven is celebrating the 20th anniversary of newborn special care at the Hospital. It is widely recognized as the first such program in the country and, in fact, the world. A brief 20 years has revolutionized the care of high-risk newborns, and there is no reason to doubt that the next 20 years will yield equally impressive accomplishments.

Not all the work that remains to be done in newborn care will come out of the laboratory or research centers. Two-thirds of all newborns who die weigh under 5½ pounds, and it is known that low birth weight is often related to the low economic status of the mother. "At least half of the babies in our Newborn unit are there because of prematurity," said Dr. Joseph B. Warshaw, director of the unit. "And the reason that many are premature is because of social ills — alcoholism, drug addiction, teenage pregnancy, poor maternal nutrition and the like." The significant challenge ahead, according to Warshaw, is not new breakthroughs in fetal surveillance or surgery *in utero*, but a commitment through social and laboratory research to preventing problems from occurring in the first place. "From society's point of view," Warshaw stated, "it's more cost effective to prevent problems than to treat them."

The past two decades have seen an extraordinary development of technology for newborn care — mechanical ventilators to aid breathing, electronic monitors, phototherapy, transcutaneous monitoring of blood gases, and newborn uses of ultrasound and CT scanning. Twenty years ago, as newborn special care was being developed at Yale-New Haven Hospital, no means existed to measure the use of oxygen; blood sampling was just beginning; nursery epidemics were major problems; and the connection between drugs administered to pregnant women and malformations in newborns (such as the thalidomide tragedy) had not been explored. The notion of newborn special care simply did not exist.

In 1959, studies conducted at Stanford University Medical Center, Palo Alto, suggested that antiseptic skin and umbilical cord care would deter the spread of infection among premature and full-term newborn infants. Until then, premature nurseries were the standard of care, with strict isolation of sick infants for fear of bacterial infections, especially Staphylococcus aureus.

Under the leadership of Dr. Louis Gluck, Yale-New Haven continued the Stanford studies and became convinced that the bacterial infections were not airborne and, therefore, isolation was unnecessary. In the fall of 1960 Gluck and his staff began the Newborn Special Care Unit of Yale-New Haven Hospital by intermingling premature infants with others requiring special care. The nine-incubator premature nursery was expanded and, in a major break from traditional methods, high-risk infants were housed together in one area.

AN INTRODUCTION TO A SPECIAL ISSUE

Following a successful trial period, the Newborn Special Care Unit was officially opened in January 1962. In 1964, a $500,000 gift from Mrs. Eleanor Naylor Dana of Wilton, Connecticut, whose grandson had been treated successfully in the unit, permitted an expansion of the unit to accommodate up to 40 infants in need of special care.

By that time a series of grants were made available for the establishment of seven other units and within a few years the new concept had become widespread throughout the country. It was a sweeping concept requiring a new approach to nursery design, nurse training, equipment design and techniques of infant care. The newborn unit became an environment in which obstetricians, neonatologists, geneticists, cardiologists, social workers and others could collaborate to develop strategies of care both for the infant and for the mother before and after delivery.

With the risk of infection under control through careful techniques of hand washing and gown sterilization, Yale-New Haven, which pioneered "rooming-in" for mothers in the forties, invited parents into the Newborn Special Care Unit on a 24-hour-a-day basis. Parents were encouraged to feed, change and caress their babies and begin, at the earliest possible moment, the parent-child relationship that is now recognized as so critical in the early weeks of life.

The unit was built around a central nursing station that permitted clear vision and easy access to the incubators. The then novel approach of suspending connections for oxygen, compressed air, suction, and electrical equipment from the ceiling cut the space requirements for each incubator almost in half. Precious set-up time for vital equipment, formerly free standing beside the incubator, was reduced, permitting emergency procedures to be more quickly and conveniently performed.

With 37 incubators, the unit is currently one of the largest in the country and serves as a major referral center for Connecticut and the Mid-Hudson Valley region of New York. It serves over 1,000 infants a year, with about 22 percent being transferred to the unit from other hospitals. Filled beyond capacity 80 percent of the time, the unit will soon be renovated to accommodate 44 incubators and room for folding cots for parents to stay with their babies. (The overhead connections, now obsolete, will be exchanged for modern connections alongside the incubators.)

One measure of the unit's success is that the mortality rate for all Yale-New Haven births hovers around the national average despite the heavy concentration of unusually sick newborns at the Hospital. "With our success, other hospitals are sending us their toughest cases," Warshaw explained. "But in addition, we are returning neonates to their hospital of origin much earlier than before. Our own success has spurred the development of higher levels of newborn care in general community hospitals."

It is estimated that 8 to 10 percent of newborns require the services of a newborn special care unit. With more than 3½ million babies born every year, the numbers benefitting from special care units are substantial indeed. "Perhaps nowhere else in medicine is the price of failure so devastating or the rewards of success so great as in neonatology," Warshaw has written. What began 20 years ago at Yale-New Haven Hospital has brightened lives around the world.

YNH

Reducing The Risk In The High-Risk Pregnancy

Each year, more than 4,000 babies are born without incident at Yale-New Haven Hospital. But another 300 "high-risk" deliveries occur, and a total of 1,000 babies a year spend time in the Hospital's Newborn Special Care Unit.

That pioneering unit, plus the availability of highly sophisticated prenatal testing, have given rise over the past 10 years to a unique perinatal program serving babies *and* mothers at risk.

The program incorporates prenatal testing early in pregnancy, a weekly clinic for mothers at risk, and emergency services for premature labor and seriously ill mothers.

"Our prenatal diagnostic area is unique," said Inge Venus, clinical studies researcher in the Department of Obstetrics and Gynecology. "We have done genetic testing on women from as far away as South Africa, India and the Fiji Islands to find out if an illness or condition present in the family or a previous pregnancy will recur."

The high-risk pregnancy program helps ease the fears of parents who may have had an unhappy experience with pregnancy in the past.

Amniocentesis, ultrasound and fetoscopy are giving parents opportunities they didn't have 10 years ago to produce healthy, normal children. Older pregnant women come from all over the state to learn through amniocentesis if they are carrying a fetus with chromosomal abnormalities. One example is Down's syndrome, a congenital condition which occurs more frequently with increasing maternal age. Hundreds of women are referred from across the United States for ultrasound testing, which can detect certain birth defects. And about 40 patients come from all over the world each year for fetoscopy (fetal blood drawing or skin sampling), which reveals the presence in a developing baby of certain genetically transmitted diseases.

These tests have allowed women the option of terminating seriously damaged fetuses at an early date. They have also put to rest the fears of many anxious parents with a history of miscarriage, stillbirth or genetic disease such as hemophilia or Cooley's anemia.

Hemophilia, for example, affects about half the male babies of women who are carriers of the lethal disease. In the past, these women often simply ruled out childbearing. With the advent of amniocentesis, which discloses fetal gender, mothers could choose to terminate male pregnancies. Now, fetoscopy can determine whether a male fetus is actually afflicted with the disease.

From the 26th week of pregnancy, all high-risk patients stop in weekly for "non-stress testing," a monitoring of the fetal heartbeat when the mother is at rest. High-risk clinic nurse Diana

Most patients require prenatal tests such as these only once. They may or may not receive further care at Yale-New Haven.

Women treated in the Hospital's high-risk pregnancy program, under the direction of Dr. Richard Berkowitz, may be referred here by another hospital, clinic or private physician for diagnosis, treatment and/or delivery. Or they may be women from the surrounding area who rely on the Hospital for their prenatal and other health care needs. Those with chronic health problems may be seen every week throughout their pregnancies — and may be admitted for the final weeks before delivery, according to

Lynch affixes a stethoscope to one mother's stomach, above, and then adjusts the monitor.

J. D. Levine

Dr. Greggory DeVore, a perinatologist. (A perinatologist is an obstetrician specializing in high-risk obstetrics.)

An outpatient clinic for high-risk mothers-to-be is held each Wednesday morning in the Hospital's Women's Center, staffed by doctors specializing in perinatology, two specially trained nurses and a social worker. About 25 patients are seen in the clinic each week, many of whom come as frequently as once a week for check-ups.

At each visit, patients are examined and are provided medical consultation. If necessary, they are referred to dietitians or other health professionals, said Diana Lynch, head nurse in the high-risk program.

The practical and emotional problems that a woman and her family frequently encounter in a high-risk pregnancy are recognized by the program's staff members, according to Dr. John Hobbins, chief of obstetrics. Sophisticated care includes not only medical attention, but attention to the social and emotional health of the family, he said.

Social worker Regina Furlong tries to see each high-risk mother on her first clinic visit. "Many of these expectant mothers have had one unhappy try at pregnancy in the past, and we are aware that they may need extra support and care," she said. Non-English-speaking Hispanic patients are seen by two Spanish-speaking social workers, Emilia Arrazcaeta and Hilda Perez.

Conditions which bring mothers to the high-risk clinic vary widely.

Some patients require special teaching as well. Diabetic mothers, for example, may have to learn to give themselves insulin injections. Parents' classes are also scheduled at the convenience of these high-risk patients, some of whom travel considerable distances to the clinic.

About 40 percent of the clinic patients are admitted to the Hospital at some point during their pregnancies, according to Ms. Lynch. The majority are able to have normal vaginal deliveries, but because there has been some risk factor involved, about 80 percent of their babies will spend time in the Newborn Special Care Unit.

While hospitalized, high-risk mothers are cared for by staff physicians trained in perinatal medicine, as well as a high-risk chief resident and the nursing staff. Usually hospitalization occurs toward the end of the pregnancy. But some mothers are admitted earlier for observation, perhaps at the point where they experienced problems in a previous pregnancy, Ms. Lynch said.

"One thing that has made the high-risk program so successful is the cooperation between the obstetrics and pediatrics staff," said Dr. Hobbins. "Pediatricians attend daily rounds with us where there are general discussions about undelivered patients. When delivery is imminent, the pediatrics staff is notified and informed more specifically about each patient. Sometimes there are pediatric surgeons literally waiting with hands washed to take over at birth."

Preparing the family for a hospitalization often involves the social workers. "Parents may request guidance with telling other children about the hospitalization or preparing them in case anything goes wrong with the pregnancy," Ms. Furlong said. "And the husband may be feeling

the strain of trying to be two places at once: with his wife and with the other children."

Conditions which bring mothers to Yale-New Haven's high-risk clinic vary widely. Many women develop a mild diabetic condition during pregnancy which is not considered serious. But more severe diabetes can compromise the health of mother and baby. A few years ago, perinatal mortality for infants of diabetic mothers was close to 50 percent. Today's methods of controlling blood sugar with insulin and fetal surveillance by ultrasound have reduced that figure nearly to the mortality rate for non-diabetics.

Women with high blood pressure are always followed closely with ultrasound, since their babies tend to be small at birth and face a mortality rate eight times higher than normal-weight babies. A small percentage of women develop hypertension as a result of pregnancy. Hypertensive patients may receive medication, and their babies may be admitted to Newborn Special Care if they are growth-retarded.

Another condition which poses a threat to mother and baby is toxemia, a pregnancy-related condition marked by high blood pressure and the presence of protein in the urine. Unchecked, toxemia can bring on convulsive attacks and miscarriage.

During non-stress testing, mothers are asked to press a button each time they feel their babies move. Ms. Lynch can then determine on a print-out whether the fetal heartbeats are accelerating during movement as they should.

J. D. Levine

The availability of excellent newborn special care draws many women from outside the area to Yale-New Haven for delivery.

Mothers who suffer from alcohol or drug abuse may require ultrasound testing every two weeks, since their babies have a poorer chance of developing normally. By measuring its head and abdominal circumference, doctors can tell whether a baby is lagging in growth, thus decreasing its chances of survival and increasing chances of neurological problems later in life. This and many other tests which are now widely used in high-risk cases were developed at Yale-New Haven, Dr. Hobbins noted.

Sometimes re-positioning the mother in bed can help, since babies are better nourished when the mother lies on her side. "When a pregnant woman lies on her back the baby compresses the flow of blood to and from the heart," Dr. DeVore explained. "When the mother is on her side, gravity shifts the uterus, and allows better blood flow to the baby."

Another common high-risk condition is Rh-disease, an immune reaction which poses danger to all babies after the first delivered by an Rh-negative mother. Following her first pregnancy — whether it ends in birth, miscarriage or abortion — the Rh-sensitized mother will develop an immune response to subsequent fetuses. The resulting destruction of fetal cells can be monitored by amniocentesis. If bilirubin (bile) levels in the baby's blood exceed normal limits early in the pregnancy, the baby may be saved by an intrauterine transfusion, a risky procedure in which blood is administered to the anemic fetus through a needle placed in its abdomen. After 32-weeks gestation, doctors can administer a drug which will hasten lung maturation in the imperiled fetus, permitting a life-saving Caesarean section.

Fortunately, cases of Rh-sensitization are declining since the introduction of the drug RhoGAM in 1968. If RhoGAM is administered after the first delivery, miscarriage, abortion, amniocentesis — or any incident where

the Rh-negative mother may bleed — the immune response will not develop in subsequent pregnancies. (Studies in Connecticut show that 95 percent of the women who need RhoGAM are now receiving it.) The survival rate for Rh babies whose mothers have been carefully followed in the high-risk program is excellent.

Multiple births — especially triplets and quadruplets — are treated as high-risk conditions because the babies tend to be premature and underweight. Certain twin gestations develop an abnormality known as twin-to-twin transfusion, where one fetus gradually transfers a significant portion of its blood volume to the other. In these cases, both babies are compromised as one grows overly large and one remains underdeveloped. This abnormality can be detected by ultrasound.

The collaboration of the entire patient care team is recognized as essential to care of the high-risk mother. "Our nurses and social workers have a good knowledge of the attitudes and problems influencing these mothers," Ms. Venus said. "If a patient doesn't come for her appointment, we reach out to her. Her continued involvement is essential, because she may be endangering her own life as well as her baby's."

Teenagers and expectant mothers with a variety of social problems often require special attention and planning, both for pregnancy and delivery and for care of their babies once they leave the hospital.

The Hospital's high-risk staff also provides specialized care to mothers who are transferred to Yale-New Haven from other hospitals. These women may suffer from serious illnesses such as pneumonia or liver disease, premature rupture of membranes or premature labor. Such patients benefit from other specialists on the staff and from the proximity of the Newborn Special Care Unit.

Women who come to the perinatal unit at Yale-New Haven are usually highly motivated to have healthy babies and are overjoyed when problems are conquered. A bulletin board in the corridor offers silent witness: from it shine the beautiful faces of dozens of children whose mothers were patients in the clinic.

"The patients send us pictures, bring in their babies — it's a very happy thing," Ms. Venus said. And that's what makes working with high-risk mothers so rewarding, added Diana Lynch. "We have patients we've followed through two or three pregnancies. It's fun to see kids you've helped to make it. And it's rewarding to have a nice outcome for parents who may have been through a bad time before."

YNH

Information Instead Of Odds

For Couples at Genetic Risk, Prenatal Diagnosis Is an Answered Prayer

Until recently, couples at genetic risk had to live with uncertainty. They knew that their children could inherit a serious, even fatal defect or disease — but they never knew if a given child would. All they could do was educate themselves, and play the odds. Family planning was a painful choice between sacrifice and risk.

Some couples chose to avoid pregnancy altogether: safe, but sad.

Couples with a sex-linked risk had another "safe" option. Since sex-linked genetic problems affect only male children, a couple could conceive, determine their unborn baby's sex, and consider abortion. But half the baby boys at risk for sex-linked birth defects are unaffected; parents lost these babies along with the affected ones.

Still other couples chose to take their chances and accept their child regardless. Even when the outcome was as wished, waiting wasn't easy.

Before prenatal diagnosis, couples at genetic risk chose between going childless or playing odds. Prenatal diagnosis offers a third, happier option: choosing out of knowledge.

All these options rest on probability; that was the problem. Today at Yale-New Haven, two new methods of prenatal diagnosis allow parents to learn the health of their unborn infants. These procedures, ultrasound examination and fetoscopy, give parents what they need to make choices they can live with — information instead of odds.

Ultrasound examination allows doctors to see the unborn infant in the womb. Modern ultrasound machines afford a variety of views: the whole baby in contour; the baby and womb in cross section; anatomical details; sequential views of a functioning organ — even motion. Ultrasound makes media stars of the unborn. Parents thrill to watch their baby's heart beat (and mothers like their mates to see the kicks they've absorbed through the pregnancy).

The technology of prenatal ultrasound is an outgrowth of *sonar*. First used to detect enemy submarines during World War II, sonar is used today to track schools of fish and map the ocean floor. Sonar employs the principle that sound waves travel easily through liquid, and bounce off solids to varying degrees. A sonar unit emits sound waves into a body of water and detects the distance and location of any object which reflects these waves back to their source.

In the mid-1960's, Australian and British physicians began to experiment with projecting sound waves into the womb. They theorized that the fetus — a semi-solid structure within a fluid environment — would reflect sound waves much as a submarine or fish does. They were right.

But why not use x-rays instead? While the safety of diagnostic x-rays for children and adults is still sometimes questioned, today's diagnostic x-ray levels are generally considered safe. There is no question about the potential danger of prenatal x-rays, however. The process of fetal development is so critical and vulnerable that all unnecessary radiation is avoided. Moreover, ultrasound differentiates soft tissues more clearly than x-rays can.

Ultrasound machines consist of two basic parts: a transducer and a console. The transducer rests on the patient's skin, projecting ultrasound into the body and detecting the returning echoes. Within the transducer, a crystal emits ultrasound (extremely high frequency sound waves) by vibrating rapidly when subjected to electric current. The transducer is wired to a console which contains the power source, main controls, and display system.

The first ultrasound machines, known as "A Mode" units, produced squiggles instead of pictures. Each ultrasound echo appeared as an elevated "blip" along a horizontal line on a display screen (see illustration, page 11).

The distance between A Mode blips was used to measure the distance between body parts along a sound wave — the front and back of a fetal skull, for instance. In fact, fetal head measurement was one of the first practical applications of prenatal ultrasound. Researchers found that an unborn baby's age can be accurately determined by its head size, and that deviations from the norm may signal developmental trouble. Dr. John Hobbins, Chief of Obstetrics at Yale-New Haven and Professor of Obstetrics and Diagnostic Radiology at Yale University School of Medicine, developed one of the first charts plotting this age/size relationship.

When interpreted by experts, A Mode ultrasonographs reveal certain aspects of fetal anatomy. But the images certainly don't look like babies. "B Mode" ultrasonographs do.

Instead of blips, B Mode echoes are displayed as tones of gray on a television screen (see illustration, page 11). Bones, which reflect the most sound, appear near-white. "Echo-spared" entities such as amniotic fluid appear as dark zones. Other structures produce intermediate tones according to their density.

When Carol Verge learned that she carries the trait for hemophilia, she and her husband Bill decided not to have children. Carol's older brother is a hemophiliac; she'd seen him suffer all her life.

Then Carol became pregnant last year. "When we found out Carol was carrying a boy, we were sure he'd have hemophilia," said Bill. The couple chose to proceed despite their pessimism. "But I knew that I didn't want to have a child with hemophilia," Carol said. "It wouldn't be fair to our (adopted) daughter."

Carol arranged to have a fetoscopy performed at Yale-New Haven Hospital. This test would tell the Verges whether their unborn son had hemophilia — but it could not be done until Carol's 25th week of pregnancy.

"Waiting was tough for us both," Bill recalled. "I hardly touched Carol's belly, and I referred to the baby as 'the fetus.' I didn't want Carol to be too disappointed if we didn't have the child."

"I didn't really admit to myself that I was pregnant," confessed Carol. "I wore all my regular clothes and went to work every day."

After Carol's fetoscopy, geneticist Dr. Maurice Mahoney told the Verges that he was "99 percent certain" their unborn son did not have hemophilia.

"We didn't celebrate," said Bill. "We had learned to be cautious."

The doctor's doubt concerned a rare form of hemophilia not detectable through fetoscopy. A blood sample from Carol's brother proved that her baby was free of this risk — and free of hemophilia.

"I went right out and bought a ton of maternity clothes," said Carol.

"And I started trying out all kinds of names," added Bill, smiling at his son Kevin.

These gray tones appear along the path of the ultrasound wave. When the doctor projects a vertical beam of sound into an expectant mother's womb, a vertical band of tones appears on the display screen. The tones are electronically "fixed" on the screen. As the doctor slides the transducer down the mother's abdomen, a vivid cross-section of the baby unfurls across the screen.

For all their wealth of information, B Mode ultrasonographs are still static images. A third mode of ultrasound, "realtime," records the unborn infant in action. Realtime machines use multiple transducers to produce multiple images of the fetus. Displayed in quick succession, these images flow together like the frames of a film to produce a motion picture. Realtime is the ultrasound that parents love best.

The prenatal ultrasound pioneers reasoned that the fetus ought to reflect sound much as a fish or submarine does. They were right.

Yale-New Haven's main perinatal ultrasound room is spacious, quiet, and curtained. Two ultrasound units the size of tall washing machines flank an examining table in the center of the room.

An ultrasound exam is done in semi-darkness. It is painless and silent; ultrasound cannot be felt, and at three and one half million cycles per second, it is pitched high above the range of human hearing.

In the first three months or "trimester" of pregnancy, ultrasound can confirm that the fetus is growing normally within the uterus. Occasionally, conception occurs outside the womb in the fallopian tubes or the abdominal cavity, and ultrasound can reveal this abnormality. And even this early in pregnancy, ultrasound can help establish fetal age.

By the second trimester, ultrasound offers a great deal of general and specific information. In addition to the fetal age, the fetal position is apparent: face-up, face-down, breech or head-first. The location and condition of the placenta can be seen as well — another indicator of how pregnancy is progressing. Twins and triplets can be distinguished in the second trimester.

The size of the growing baby is closely followed through successive ultrasound exams, as is the quantity of fluid in the womb. Certain birth defects are foreshadowed by high or low fluid levels; abnormal findings call for follow-up study.

Ultrasound uncovers birth defects which result in altered anatomical size, shape, or texture. Some of the problems that can arise in the course of pregnancy are surprising in their nature. Not surprisingly, some of the most serious problems involve the fetal head.

One in every 1,500 pregnancies in America is affected by *anencephaly* — a condition in which the baby's head fails to develop. Ultrasound can detect this as early as the fifteenth week, sparing mothers the anguish of carrying an irrevocably doomed baby to term.

Another congenital defect, *microcephaly*, results in an extremely small head with subnormal brain development and associated grave anomalies. Two rare forms of this condition are inherited; more commonly, microcephalic babies are conceived by chronically alcoholic mothers — a grim reminder of alcohol's threat to the unborn.

In *hydrocephaly* ("water on the brain"), the baby's skull swells with accumulated fluid. The future of a hydrocephalic infant depends on the severity of the condition. In many cases, a post-natal "shunting" operation relieves the pressure by re-routing the excess fluid to drain harmlessly into the infant's abdominal cavity. Babies with the most severe hydrocephaly cannot survive. Through prenatal diagnosis, arrangements can be made to deliver infants with a favorable prognosis in an institution where specialized postnatal surgery is available.

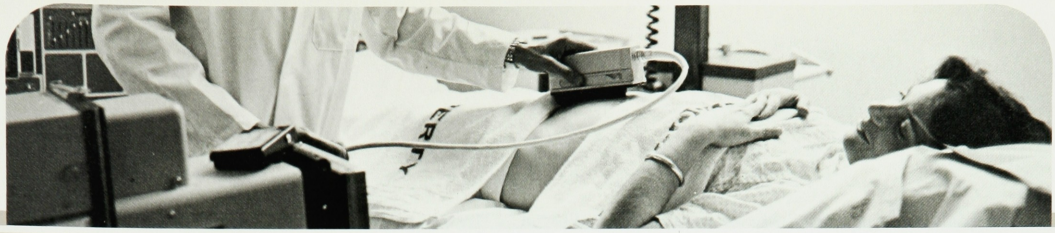
The growing spine is studied closely, too. Proper spinal development is critical; the spine is the neural highway. In a class of defects known collectively as spina bifida, the neural tube does not completely close. Spina bifida has a great range of severity, and may be accompanied by other anomalies. Scanning for spina bifida with ultrasound is slow, exacting work because these defects can only be seen from certain angles. However, the information to be gained rewards the effort. Spinal tumors, rare and inevitably fatal, are also visible with ultrasound.

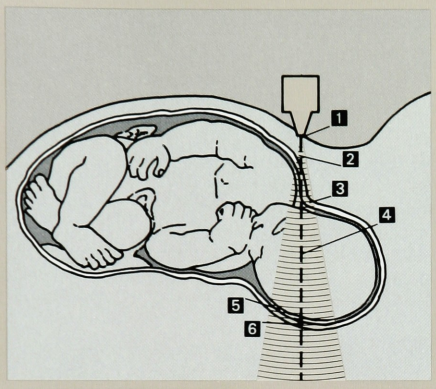
In examining the fetal chest, a new ultrasound technique called *echocardiography* lets doctors study heart function as well as chest structure.

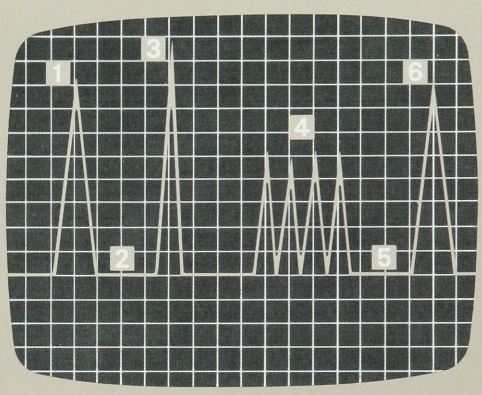
"One woman was sent to us when her doctor heard an irregular fetal heartbeat," Dr. Hobbins said. "Ultrasound indicated that the baby was swollen with fluid in the lungs and abdomen. An echocardiogram revealed a rhythmic disorder called atrial flutter; the baby was in heart failure.

"We did an emergency Caesarean and immediately gave the baby an electric shock to restore proper heart rhythm. Echocardiography saved that baby's life."

Even when ultrasound can't save a baby, it can save needless anguish and expense. Fetuses with *renal agenesis*

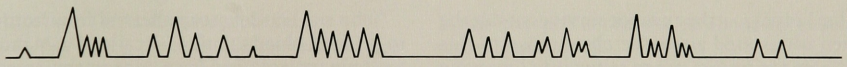






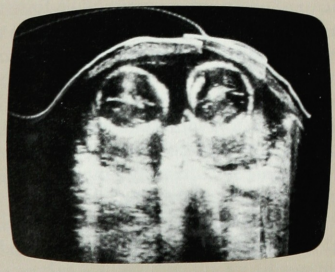
The first ultrasound machines displayed rather abstract information, as the above drawing illustrates. The graph is a typical fetal ultrasonograph; each elevated "blip" corresponds with ultrasound waves echoing off some part of the mother or baby. Higher blips indicate stronger echoes (from denser structures). Note that the line is flat where the sound passes through the perfect medium of fluid. As the blips progress from left to right, they indicate structures at increasing distance from the transducer.

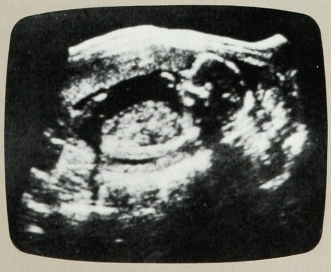
While early fetal ultrasonographs provided vital information, it took great skill and persistence to derive a sense of the whole baby from these wiggly lines.

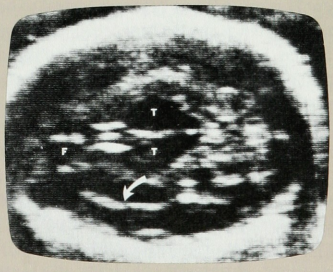


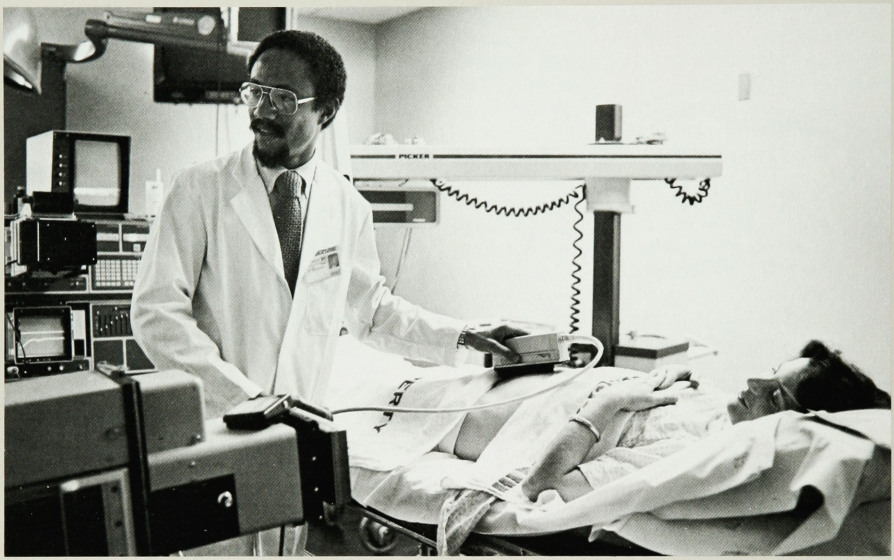
A "B Mode" ultrasonograph, by contrast, is a black and white, two dimensional image of the infant — a picture. Some B Mode ultrasonographs are startlingly clear. In the image at bottom left, these twins' facial features can easily be seen. The baby sucking its thumb (bottom center) is a bit harder to interpret. And for the uninitiated, the ultrasonograph of a cranial cross-section (bottom right) may as well be an aerial weather map.

To the trained ultrasonographer, however, all three images are clear and informative.









J D. Levine

fail to develop kidneys — they cannot survive outside the womb. When ultrasound alerts the obstetrician to this condition, he or she knows *not* to swing into lifesaving heroics when the emerging baby registers distress on the fetal monitor.

Many of the anomalies revealed by ultrasound are uncorrectable, and a number are inevitably fatal. Yet, it is nonetheless of value to peer into the womb, and know. In the past four and a half years, some 450 mothers at risk for fetal anomaly were examined with ultrasound at Yale-New Haven. All but 60 were found to be carrying healthy children, and they completed their pregnancies much relieved. For the minority whose babies did have problems, ultrasound provided evidence to consider abortion or arrange for special postnatal care.

Ultrasound, however valuable, cannot reveal certain congenital diseases such as sickle cell anemia, thalassemia, or harlequin syndrome, which only show up in fetal blood or skin samples. Fetoscopy — a method of collecting such samples — was developed in 1972 at Yale-New Haven by Dr. Hobbins and Dr. Maurice J. Mahoney, Associate Professor of Human Genetics, Pediatrics, Obstetrics and Gynecology at Yale University School of Medicine, and director of Yale-New Haven's prenatal diagnosis program.

"John and I sat down together and brainstormed on ways to get fetal blood samples," recalled Dr. Mahoney. "Some preliminary work had been done in this area, but people were justly concerned about safety. We got the idea to enter the womb with an endoscope."

The endoscope is a tool for viewing tiny body cavities. One early use for the endoscope was the study of arthritic knees and shoulders — in fact, it was also known as an "arthroscope." The tiny lenses of an endoscope are linked by a thin, flexible fiber optic system; the front lens is housed in a needle to allow insertion into the body.

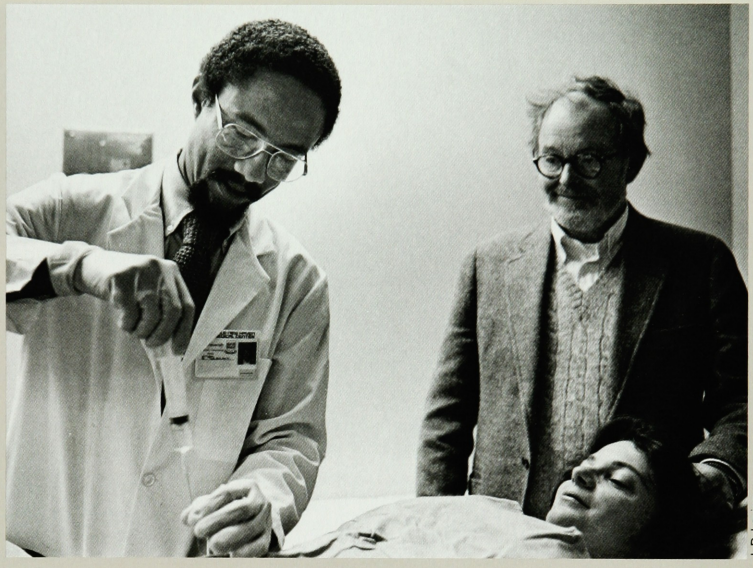
Through a Massachusetts firm, the doctors found an endoscope adaptable to their purposes and began developing their fetoscopy technique.

Initially, the team used the endoscope both to view the fetus and as a means of getting a blood or skin sample. But the endoscope has a narrow field of view — one or two square inches — and modern ultrasonography has displaced it almost entirely for fetal viewing.

The endoscope's limited vision is ideal, however, for orienting surgical instruments *in utero*. Modern endoscopes carry their needle or pincers right next to the viewing lens; what you see is what you get. Skin samples are taken from the baby's scalp — hair soon covers any scar — and blood samples are drawn from the placental

(left)
Dr. Peter Grannum and an expectant mother watch an ultrasound screen (off-camera) which shows her unborn baby in motion.
There are many reasons for prenatal ultrasound examination. Here, Dr. Grannum scans to see where the baby isn't before performing amniocentesis — the withdrawal of amniotic fluid from the womb for laboratory tests. Amniotic fluid accumulates in unoccupied areas of the womb; drawing fluid from one of these "pockets" is safest for the baby.

(right)
As Dr. Grannum concludes this procedure, the father looks on. This mother is being tested because her age — over 35 — puts her child at greater risk of Down's syndrome. Amniocentesis can also reveal other chromosomal anomalies and over 100 biochemically-caused birth disorders.



J. D Levine

wall or umbilical cord. It's a delicate procedure.

For the first two years, through 200 procedures, the doctors examined only women scheduled to have subsequent abortions. They were concerned about the fetal risk posed by inserting an instrument through the abdominal wall and into the womb. To minimize this risk, each patient was studied with ultrasound prior to fetoscopy to establish the orientation of the fetus.

Finally, the pioneers felt prepared for patients who hoped to deliver. Their first patient was a mother at risk to transmit thalassemia, a form of anemia which dooms its victims to a short and painful life. After a suspenseful wait, good news came back from the lab: the baby was unaffected!

Since that first success, nearly 200 fetoscopies have been performed at Yale-New Haven. Only three medical centers in the United States, and some dozen in the world, offer fetoscopy. It is likely to remain a service of relatively few major medical centers because doing fetoscopy well demands a sizable, steady caseload.

Yale-New Haven's fetoscopy patients come from around the country and around the world. One of their most important steps before Hospital admission is a counseling session with clinical researcher Inge Venus. Ms. Venus reviews each patient's genetic situation, explains the procedure she is about to experience, and answers questions.

"Our whole effort is directed toward avoiding needless abortions," explained Ms. Venus. "Before fetoscopy, for instance, a couple at risk for hemophilia would have amniocentesis and automatically abort a male fetus. Half of the time, couples lost perfectly healthy baby boys. Fetoscopy saves these healthy babies."

But fetoscopy itself presents certain risks. About five percent of all fetoscopy procedures prove fatal to the fetus, and fetoscopy also creates a slight increase in prematurity. It is preferable not to subject a baby to this risk if its mother intends to deliver despite the findings.

In a recent meeting of medical experts, fetoscopy was deemed an "applied research procedure" — in lay terms, it has demonstrated its practical value. Fetoscopy's founders feels that this is only the beginning.

"We think and talk about microsurgery inside the womb — correcting some of the problems that now we can only detect," Dr. Mahoney reveals. "We're not near that yet; we need to know more about the pharmacology and physiology of uterine muscle. But I think fetoscopy will be part of the path to new therapeutic as well as diagnostic techniques: access to the unborn baby we never had before." YNH

A Close Look At A Special Place

Siegfried Halus

Amazed. Overwhelmed. Hopeful. Heartbroken. Frightened.

A first-time visitor to Yale-New Haven Hospital's Newborn Special Care Unit — whether a casual observer or anxious parent — may experience all these feelings in a matter of seconds. The tiny babies, some with arms and legs no bigger than an index finger, are an amazing sight. The high technology surrounding them is overwhelming. The attentive nurses who feed and rock and coo at these infants inspire gratitude and hope. The babies, confined to plastic incubators instead of lovingly selected cradles, are heartbreaking. And the unfamiliar array of tubes, monitors and life-support machines is somehow frightening.

But the more you learn about this very special unit — the first of its kind in the world — the less frightening and more amazing it becomes.

"This is a place where the highest risk baby can be delivered with the greatest chance of survival," Dr. Joseph Warshaw, who for seven years has been clinical director of the Newborn Special Care Unit (NBSCU), explained simply. "We now have the technology to keep premature babies alive outside the womb from 26 weeks gestation (40 weeks is full term), and we can save infants with a birth weight of 1½ pounds."

Teamwork between obstetricians and pediatricians has improved the care of newborns.

Just five years ago, the survival rate for babies that small was only 10 percent. Today, at Yale-New Haven, it's close to 70 percent. Babies born at 3 to 5 pounds, including the sickest transported here from around the state, have a survival rate of 96 percent.

These dramatic figures can be attributed to four things, Dr. Warshaw believes.

"First, we have a better understanding of how to apply the technology available to us today to newborn care," he said. All those wires and tubes which appear so frightening at first are symbols of progress — of life, rather than illness. Ventilators to assist in breathing, electronic monitoring of pulse and blood pressure, methods of sampling and monitoring blood gases — all are developments of the last 20 years.

Unit director Dr. Joseph Warshaw likes to check on each patient personally, both in and out of the incubators.

Siegfried Halus

Nurse Marlene Cruite instructs a new mother in the care and bathing of her infant.

So is our present understanding of newborn physiology and nutritional needs. Some developmental abnormalities can be detected and treated before birth, and high-risk conditions can be anticipated about 60 percent of the time. Low birth weight babies can be fed by vein or stomach tube, and in some cases can receive their mother's own breast milk this way.

Third, the relationship between neonatology and obstetrics has been strengthened considerably. "We now work as a team, both before and after birth," Dr. Warshaw said.

And finally, part of Yale-New Haven's success with the tiniest babies can simply be credited to 20 years of experience, according to Dr. Warshaw. The unit, which normally houses 37 bassinets, is seldom undersubscribed. The census frequently hovers close to 45, and 50 babies at once is not unheard of. On those days, the unit virtually explodes

Siegfried Halus

To the uninitiated, the wires, lights and monitors are an intimidating sight. All that technology is making the tiny infant in the incubator healthy and strong, however, while allowing easy access by the staff. Nurse Connie Hanrahan checks a heartbeat.

with activity, as the staff bustles around the closely packed incubators.

"We're a therapeutic community, professionals from different areas working and fighting together for these babies," Dr. Warshaw explained. In addition to the permanent medical staff of three physicians, there are resident physicians, attending pediatricians, consulting specialists and a nursing staff of 50 providing around-the-clock care. Social workers can always be found in or near the unit by parents in need of counseling, practical help or just a sympathetic ear.

Every morning and afternoon senior citizens from the New Haven area's "foster grandparents" program don gowns to hold, feed and rock the babies.

And, of course, there are always parents and siblings visiting the newborns.

"We take a very consumer-oriented approach in the unit," Dr. Warshaw said. "We feel these babies belong to the families, not the hospital, and we encourage family members to be here as much as possible." Parents are instructed in the proper washing procedure so they, too, can hold and feed their babies. Never is a parent made to feel "in the way" in this unit.

Who are these babies and how do they get here?

"Our patients come to us from three populations," Dr. Warshaw said. "There are those anticipated high-risk mothers who come here from around the state to deliver because it makes more sense than transporting a newborn to the unit. Then we have about 300 babies a year transferred here from other hospitals in Connecticut and New York. And there are the babies who happen to be born here with problems which may or may not have been anticipated."

A regional approach to newborn special care has been very successful in Connecticut, he noted, and Yale-New Haven's NBSCU enjoys a good relationship with surrounding community hospitals and private physicians.

"People have accepted the concept that you need very few places as sophisticated as this. They recognize that there is much to gain by being part of the network," he said.

Problems which might send a newborn to the NBSCU range from prematurity and low birth weight to birth trauma, infection and congenital malformations. Drawing from a wide and populous region, the unit naturally receives some unusual and rare cases as well as the routine.

The nursing staff is the unit's cornerstone, providing care and love around the clock.

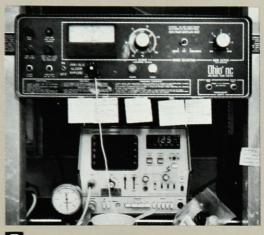
When trouble is anticipated or arises unexpectedly during a delivery at Yale-New Haven, a pediatrician is notified immediately. This physician brings life support equipment into the delivery room, and does what is necessary to stabilize the newborn. Then it's off to the unit, just down the hall.

Even if the baby of a known high-risk mother — a diabetic, for example — is born healthy, as a precaution he or she will be taken to the unit briefly for observation.

Some problems such as congenital malformations are correctable shortly after birth. Major surgery is performed in the operating room, but minor surgical procedures such as spinal taps, arterial catheterization or circumcision may take place in the NBSCU.

Most babies are placed in one of the unit's three large wards, but there are isolation rooms available as well. Unit staff members wear clean gowns and always wash carefully with antibacterial soap before they handle a baby. The clear plastic incubators provide a warm, moist environment. Tubes which provide oxygen and wires connecting to important monitoring equipment hang

The High-Tech Crib



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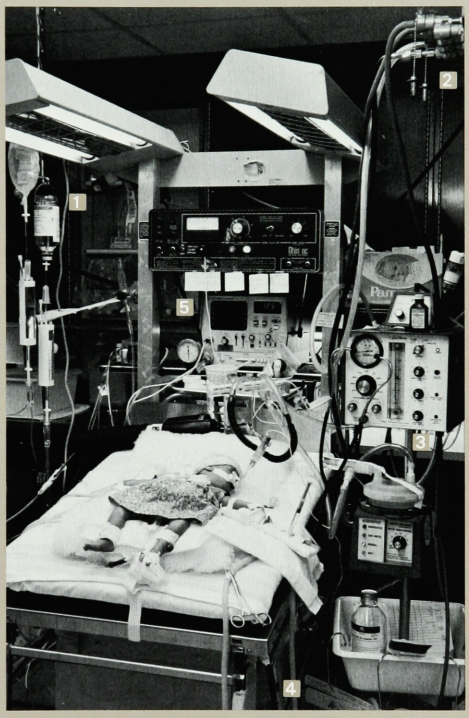

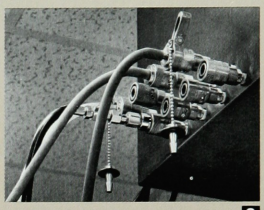

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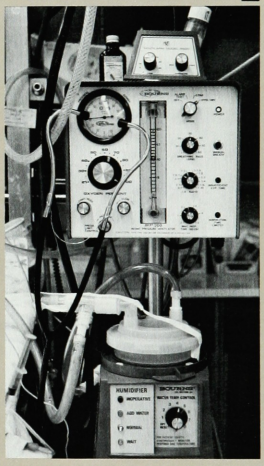

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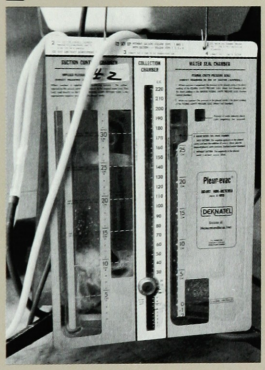


The tubes, wires, pumps and monitors attached to tiny babies in the NBSCU may look frightening, but they are lifesaving. These devices do for infants what they cannot yet do for themselves.

The baby above is premature and in respiratory distress. As he rests on a lambswool-covered water mattress, the surrounding apparatus monitors and supports his vital functions.

Intravenous solutions (1) provide nourishment. Air and oxygen (2) flows through a ventilator (3) which offers respiratory aid ranging from low-level supplementary oxygen to machine-assisted breathing. This baby has a *pneumothorax:* a leak in one lung. A small hose through his chest wall is attached to this "Pleur-evac" bag (4) which maintains a slight vacuum to keep the baby's damaged lung from collapsing.

The upper machine (5) above the mattress monitors the baby's skin temperature and activates heat lamps to maintain it within a pre-set range. The lower unit — a cardiac monitor — continuously displays the baby's pulse rate and blood pressure, and sounds an alarm to signal cardiac distress.

"It's a thrill to help babies graduate from these machines to their parents' care at home," says one NBSCU nurse.

David Gaynes

from the ceiling, making it easier for the staff to handle the babies and maneuver around the unit. There are usually several babies requiring assisted ventilation, Dr. Warshaw noted. Wires directly attached to the infants keep close tabs on blood pressure, pulse and oxygen in the blood.

Many high-risk problems are preventable, and education and research will help decrease their occurrence.

The NBSCU's nurses are its cornerstone, according to Dr. Warshaw. "We do have a very stable nursing population, many of whom have been here more than five years," said Jeryl Gagliardi, neonatal nurse practitioner on the unit. This is unusual in a stressful work environment such as intensive care, she said, where the workload never really lets up. "There is no quiet time, and we often have only 10 minutes notice to set up for a very sick baby."

Ms. Gagliardi, who came to the unit in 1957 when it was actually a nursery for premature babies, has seen the nursing staff grow in numbers and technical skill. "Nurses are an important part of decision-making here, since they are in constant contact with the babies and the families," she said.

In addition to the care they provide, the unit's nurses also give the babies love which the parents can't physically provide over a 24-hour period. "The parents know this, and they appreciate it," Ms. Gagliardi said.

Many of the babies wear tiny stocking caps to preserve their body heat, and some sport doll-size clothing made by their parents. "We have a whole room full of tiny clothes in back — and a washer and drier donated by General Electric to keep them clean!" Ms. Gagliardi said. Parents are encouraged to bring in clothing, booties, toys, music boxes — anything which will help give them a sense of normalcy in their developing relationship with the newborn.

In some cases, "rooming-in" is available for parents over a short period of time. "I call it the Hilton suite," Ms. Gagliardi laughed, pointing to a conference room next door which can be temporarily outfitted with cots.

"You just can't run a unit like this with rules that can't be bent sometimes," she added. "You've got to be flexible."

At one time babies had to weigh at least five pounds before they were discharged from the hospital, but this is no longer true at Yale-New Haven, Dr. Warshaw said. "When the family can do what the nurses have been doing for a baby, it's time to go home," he said. "We've discharged 3½-pound babies." Statistically, the average length of stay in the NBSCU is 12 days, but very premature babies have remained as long as three months.

Although units like Yale-New Haven's NBSCU are giving premature and sick infants the best chance for survival they've ever had, infant mortality and the incidence of low birth weight in the United States remains high among industrialized nations. "The incidence of perinatal disease in New Haven is much higher than in Stockholm, Sweden," Dr. Warshaw noted. "This is a reflection of America's social ills. Despite all we can do to deal with perinatal problems such as prematurity and low birth weight, we still aren't preventing them from occurring in the first place."

Behind many high-risk pregnancies is a history of poverty, malnutrition and ignorance about health care. "Much of this is preventable — for example, problems which result from drinking or smoking during pregnancy," Dr. Warshaw said. "Education has to be part of a place like this."

So does research. The research group that Dr. Warshaw directs has about half a million dollars in research grants each year — and that doesn't go very far, he stressed. "We study how things develop normally so we'll understand better what can go wrong and how to treat it," he said. Particularly important are studies of lung development, since a baby cannot survive outside the womb until its lungs can function. Thanks to research it is now possible both to delay delivery and speed up lung maturation using drugs.

"One of the hallmarks of our unit is that it is a place where people can move ahead by asking and answering questions," Dr. Warshaw said.

Unfortunately, the highly sophisticated long-term care provided by a newborn intensive care unit generates a staggering cost to the consumer, "It can easily cost the family of a premature baby $50,000 for this kind of care, and our per day costs at Yale-New Haven are among the lowest around," Dr. Warshaw said. "One of the issues facing neonatal medicine — and society — today is whether we are willing to support the enormous cost of newborn special care. Is it worth the effort and expense to save a 1½-pound baby, and should we strive to push that figure even lower?"

One factor influencing the answer to this question would be the quality of life these babies can look forward to. And although long-term follow-up has been "haphazard" at best in this rather new medical specialty, Dr. Warshaw said, the majority of low birth weight babies seem to be

Siegfried Halus

Preparing for a minor surgical procedure are from left, Fran Jankowski, R.N., Dr. Larry Gottlieb, Dr. Mary Gregg and Betty Ditmeyer, R.N.

enjoying normal, healthy lives as they grow. "Simply being small or having ordinary complications at birth ultimately seems to put you at no greater health risk than a full-term baby," he said. "Even babies with more serious problems, such as hyaline membrane disease (a respiratory disorder) or bleeding into the head are showing normal mean IQs further along in life. The great majority can look forward to a good outcome and a productive life." YNH

Commentary

SOME REMINISCENCES

Louis Gluck, M.D.

Professor of Pediatrics and Reproductive Medicine, University of California, San Diego

Dr. Louis Gluck at National Institutes of Health Conference at Yale-New Haven Hospital, Dec. 1967.

I am jaded enough that I expected to feel no particular excitement about October 1980. I was wrong. As we entered October 1980, I found myself very excited, for this marked 20 years since I had been given the unique opportunity to develop the Newborn Special Care Unit at Yale-New Haven Hospital.

I came to Yale from Stanford University in July 1960, told that I would be allowed to develop a prototype intensive and special care unit for prematures and newborns. None existed anywhere at that time. I had been given "permission" by a state health official who, with great trepidation, declared that as a faculty member at Yale I was entitled to some experimentation. But he also concluded that "if anything goes wrong, I don't know who you are." This kind of "permission" was humbling.

In a series of formal, detailed discussions, I met with the staff of the then "premature infant unit." We discussed how to expand the role of nurses, how to convert the premature infant nursery into a unit that would accept all sick infants — medical, surgical, infected, non-infected, those born in the hospital and elsewhere, how we would train a new breed of nurses and physicians, how we would export to other hospitals our special expertise in stabilization and management of acutely ill and depressed newborn babies. In short, we sought to develop the skills necessary to produce healthy babies and to provide education and support to pediatricians, obstetricians and nurses.

Today this seems an anemic charge, but it was very bold — even visionary — in 1960, when many laws separated babies from physicians, nurses, parents, and other caregivers. Isolation practices were launched on even the mere suggestion of illness. There was almost universal fear that the vicious pandemic Staphylococcus aureus would descend upon the nursery and kill babies. This was not an unrealistic fear; staphylococcal fatalities had led to many public health edicts urging stringent isolation and "antisepsis" techniques. The traditional defense against the ubiquitous staphylococcus was to put a few babies into a small room and to deny nearly everyone, including families, contact with them. If an infant and mother were infected, however, they became an epidemiologic unit and frequently were isolated together.

While our (and other) studies showed the newborn to be a veritable culture medium for staphylococcus, these studies also proved that unwashed hands spread the organism around nurseries, and that careful hand washing and cleansing the infants prevented any spread of disease. This was our justification for bringing a large number and variety of babies together.

There was some precedent for developing newborn special and intensive care in the formation of coronary care units and, to a lesser extent, intensive care units for older children. In a few institutions, some sick newborns were transferred into childrens' intensive care units. It seemed clear to me that the painstaking techniques for feeding immature babies, the great powers of observation of premature nursery nurses, the specialized facilities (stone aged, by comparison today) and emerging techniques, all pointed to the need for converting these premature nursery units to care for all newborns with special problems.

In 1960 Yale was ripe for a new endeavor in delivering newborn care. Thanks to the compassionate Dr. Edith Jackson, who initiated "rooming in" in 1944, infants here were in close contact with their mothers right after birth for at least two hours. Dr. Jackson promoted bonding and attachment, even with premature infants, by bringing parents into premature nurseries (long before this was sanctioned by state health laws). I had the good sense to follow Dr. Jackson's lead, which is standard care today, by bringing parents into sick newborn areas as part of therapy. Effective love between mother and infant requires contact.

The early founding days of the unit were very trying, and there were questions about the wisdom of such a venture. Strong support came from Dr. Nelson Ordway, then professor of pediatrics and the most consummate bedside teacher I have ever seen, who felt from the outset that this was a valuable and necessary development,

The Newborn Special Care Unit under construction, Nov. 1966 . . . and Jan. 1967.

and from Dr. William Lattanzi of New Haven.

Knowing what constituted intensive care was difficult, lacking as we did both guidance and precedent. Part of our work had to extend into the delivery room. Since I had exposure to and training with Dr. Virginia Apgar, I was able to emphasize and teach endotracheal intubation and resuscitation of infants to the pediatric residents, whom we introduced into the delivery room. Dr. Lee Buxton, then chairman of the Department of Obstetrics and Gynecology, at first questioned, then indulged, and then welcomed our presence. In six months we became nearly indispensible in the delivery room.

We adapted existing adult and pediatric intensive care techniques to prematures and newborns. We developed transport procedures for patients from outlying hospitals and experimented with different architectural schemes, learning that babies received better care in large rooms rather than in the little cubicles prescribed by law. Adult equipment adapted for infants included mechanical ventilators, electrocardiographic machines, infusion pumps, and monitoring equipment. Over the first few years rudimentary intensive care slowly developed. We knew little of electrical hazards or of sophisticated techniques. Occasionally, an infant on a ventilator actually survived, giving us hope that the extraordinarily high mortality from respiratory distress syndrome could be reduced.

In 1962 Dr. Edward Hon, pioneer developer of electronic fetal monitoring, returned to the Yale Department of Obstetrics. Together we founded the first known perinatal unit with joint training of residents and fellows. What incredible excitement there was in those days! Every day we developed more confidence and sophistication. This was infectious, and soon pediatric and obstetric residents began to appreciate the great opportunities of this new frontier: perinatal medicine.

There were two important firsts of which I am very proud. Under the leadership of the remarkable Ruth Breslin, Yale-New Haven began providing social services to the families of sick and premature newborns, with emphasis on family crisis. This is now considered essential to any special care unit. And this Hospital saw the advent of continuing and graduate education in perinatal medicine, with the frequent workshops and training programs we presented for community hospital doctors and nurses.

Shortly before Christmas of 1964 we admitted to our unit — I transported the infant myself — newborn Jeffrey Kusch, son of Robert and Anne Kusch, and grandson of the late tycoon, Charles A. Dana. The child survived respiratory distress syndrome and went home shortly after the holiday. A grateful, very generous Dana family recognized the potential of neonatal intensive care units and wished to participate as pioneers. They gave us $500,000 at first, and later other gifts that enabled us to plan and develop the Eleanor Naylor Dana Newborn Special Care Unit. The generosity of the Dana family also allowed us to develop large-room care, which is now standard. In designing the center, we found it a great advantage to suspend oxygen, suction, air and electricity connections from the ceiling. This made floor space entirely flexible and enlarged the effective floor space per baby.

In 1967, shortly after dedication of the Eleanor Naylor Dana Newborn Special Care Unit, the National Institutes of Child Health and Human Development convened a meeting at Yale with many neonatologists, obstetricians, architects, nurses, and others concerned with perinatal and infant care. In many ways, our approach to newborn intensive and special care was sanctioned at that time.

The only thing I have found more exciting than those early days is the present; newborn intensive and special care has advanced so much that it bears little resemblance to the "old days." Today, very little cannot be done to save the life of an infant, no matter how small or how ill.

For me, Yale-New Haven Hospital was the best place to have been in 1960 — beyond question. YNH

The Rh Factor:
A Picture Story

Mark Landry was born at Yale-New Haven Hospital on December 26, 1980. He was delivered by Caesarean section and weighed 5 lb. 8 oz. After one complete and one partial blood transfusion, five days in the Newborn Special Care Unit and a day in the regular nursery, Mark joined his family at home. He was an "Rh baby."

The picture story that follows illustrates Mark's (and his parents') recent experience at Yale-New Haven from the time Lorraine Landry consulted with specialists in the high-risk maternity clinic to when she took Mark home to his brothers and sister.

Mark was the Landry's fourth child and the second born at Yale-New Haven. Mrs. Landry was Rh negative — her blood lacked the Rh antigen, a life-threatening condition for any children following the firstborn. After the first pregnancy, Rh-sensitized mothers can develop antibodies that attack the red blood cells of any subsequent fetus with Rh-positive blood. These antibodies, crossing the placenta to the fetus, slowly destroy enough red cells to make the fetus anemic and, eventually, at risk of death.

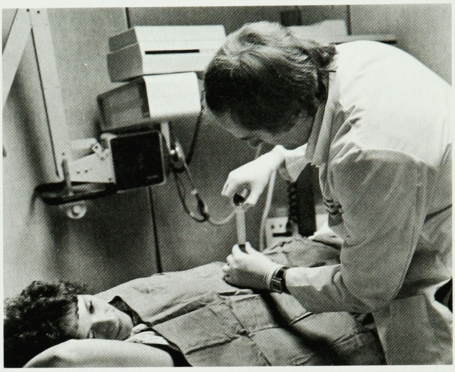
If the antibody-blocking drug RhoGAM is administered before the mother develops these antibodies, she can deliver subsequent children without difficulty. Mrs. Landry, however, was Rh-sensitized in the 28th week of her first pregnancy and RhoGAM was not an option.

Her first child, Eric, was born by normal delivery in 1974. Philip (1977) required two blood transfusions after delivery to combat anemia. Chantal (1979) received two intrauterine transfusions and was delivered by Caesarean section at 36 weeks, weighing 3 lb. 9 oz. After delivery, she spent a week in Yale-New Haven's Newborn Special Care Unit and received two more partial transfusions.

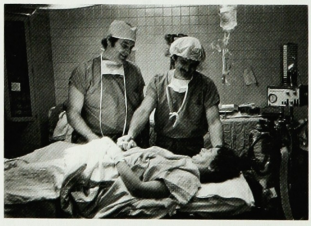
The problems of the Rh factor can be effectively managed if the expertise is at hand. All the Landrys' children are healthy and strong. If they desire more children, they can have them with confidence.

photos by Siegfried Halus

(Right) Ultrasound detects fetal positioning prior to amniocentesis. (From top-right down) Mrs. Landry consults in the high-risk clinic with Dr. Roberto Romero; the amniotic fluid reveals the degree of Rh problem, and fetal lung maturity; the C-section team prepares for delivery; Mrs. Landry's husband, Marcel, offers comfort during the procedure. (Overleaf) It's a boy!



(Above) Mark is checked out in the Newborn Special Care Unit by Dr. José Muñoz, Dr. Sharon Kurzner and Joyce Robinson, R.N. (Below left; right) Mark's father, Marcel, gets used to his fourth; "All's well that ends well."



David B. Gaynes

Newborn Social Work: Helping the Whole Family

Newborns in trouble have families in trouble. Even for the most stable families, having a baby admitted to the Newborn Special Care Unit (NBSCU) can cause an emotional crisis. Families of newborns in trouble need special care.

This was clear from the beginning of Yale-New Haven's NBSCU. So from the beginning, the Unit has worked to unite healthy babies with healthy families. Medical intensive care is merely the most evident step towards this ultimate goal. It is fruitless to win an infant's life unless someone will nurture and raise it.

Saving babies in trouble has more lasting meaning if their parents are prepared to raise them.

Every Unit staff member works with families, but family care is the special charge of social workers Regina Furlong and Jacqueline L'Heureux. Theirs is a challenging, demanding job. They must understand myriad medical terms and procedures; follow the ever-changing status of some 40 babies; and help anxious parents, siblings, extended family and friends adapt constructively to the unexpected pressures of these babies' births. They offer help to every family, tailored to the special needs of each.

Newborn intensive care at Yale-New Haven is a team effort of experts. Unit doctors and nurses work to solve each baby's medical problems — to make the baby available to its family. At the same time, Ms. L'Heureux and Ms. Furlong help each family deal with the psychological and practical aspects of their situation — making the family available to their challenging new baby.

Compared with the complex NBSCU nursery, little technology is visible in the social workers' office, or in their daily work. But the science which guides the social workers is as well-defined as that of their medical colleagues.

Both social workers recognize the value of continuous, intimate parent-child contact from birth onward. But when a newborn's health is threatened, medical care interrupts this contact. "We try to take pictures of all the babies right away," Ms. Furlong reported. "If the baby is a transfer patient, we send the picture back to the hospitalized mother. It's just amazing to see a new mother with a picture of her baby — she begins to relate to her infant through the picture."

Photographs can help meet special emotional needs. One baby born with an omphalocele (a length of intestine protruding through the abdominal wall) was whisked away for surgery before his mother could get a good look at him. After surgery, the bandage-swathed baby was returned to his mother — along with a photograph of him taken just before the operation.

J.D. Levine

Ms. Furlong answers the last-minute questions of this Norwich couple. The mother is ready to go home after her brief post-delivery stay, but her baby — like some 1,000 babies a year — will remain in the NBSCU until its size and health are satisfactory.

"This mother was so grateful for the picture," Ms. Furlong said. "Through ultrasound, she had known for months that her baby had this problem. She had studied it, seen pictures of affected newborns, and imagined what her baby might look like. But she really needed to see her own baby just the way he arrived."

The greatest hurdle NBSCU parents must clear is not physical separation from their babies, but fear of a more profound separation: death. Parents who fear for their baby's life may withdraw, but they must be encouraged to relate to their baby for two reasons — their baby may live; their baby may die.

While the astounding majority of NBSCU babies do survive, helping parents grieve for those who do not is one of the social workers' most important roles. "Society doesn't let parents grieve for their newborns — not long enough or deeply enough," said Ms. L'Heureux. "Parents may sometimes be told by family and well-meaning friends

that they can have other children, or that it's time to get on with living."

But infant death is as traumatic as any death can be. It is hard to bury a life's-worth of unrealized dreams. This is why Ms. L'Heureux and Ms. Furlong support the parents in holding and knowing their children no matter how grave the case. Even parents who have been at first reluctant come to cherish their brief time with their dying infant. Only when a child has been real to them, can parents mourn his or her life. What is called "grief work" must be done; otherwise, grief may evolve into symptoms that can plague a family and last a lifetime.

Grieving must be done when the infant lives as well. The birth of every premature child or child with defects or disease is the loss of the perfect child who never came. This phantom can interfere with the living family if it is not laid to rest. So can many other factors.

This mother, a patient in the high-risk Obstetrics/Gynecology program, undergoes amniocentesis twice each month. She finds Ms. Furlong's presence a real source of comfort during these tests.

J.D. Levine

"We know that parents of premature children may be overcome with guilt," said Ruth Breslin, Director of Social Work in Obstetrics, Gynecology and Perinatal Medicine. "The mother especially experiences this as her failure and thinks, 'If only I hadn't tried to keep working.' The father may think 'I made this happen — I shouldn't have left her to worry alone while I took that business trip.'

"While the physician may tell these parents that prematurity is an accident that is no one's fault, our job is to help the parents deal with their psychological response to the situation," Mrs. Breslin continued. As with all information, this may be offered repeatedly and in varied ways. "The ears can't hear when the head can't think," explained one NBSCU mother.

The birth of the child with problems is the loss of the perfect child who never appeared. For the sake of the living, this phantom-child must be laid to rest.

Parents of a child with birth defects often feel inadequate and angry, Mrs. Breslin explained. They "made" their child, and may feel that they failed somehow. And they wonder *why* this terrible thing has happened to *them*.

To compound problems, parents of premature or defective babies feel cut off. Their circle of family and friends, poised for a blessed event, are paralyzed with "congratulations" stuck in their throats. Few wish to probe a parent's panic or ambivalence.

Crisis theorists describe crisis as an emotional upheaval caused by unexpected events, and hold that individuals are most open to aid soon after "crisis impact." With time, "rigid defenses and maladaptive solutions" can set in to make the road to constructive adjustment much harder.

The social workers offer individualized guidance and therapeutic intervention to families in crisis. "We don't just hold hands and chat with these parents; we provide preventive psychiatry," Ms. Furlong said.

Acceptance builds trust. When parents confess, "I feel like I'm falling apart," the social workers can rightfully tell them how normal this feeling is. But they don't leave it at that.

J D Levine

Sometimes, mothers and their babies share an extended hospital stay. While this mother has been recovering from post-delivery surgery, her baby has been growing strong in the NBSCU. Here, Ms. L'Heureux brings the baby up for an afternoon visit — or nap — with Mom and Dad.

"From our very first contact, and in every exchange, we're constantly assessing each individual's strengths and coping style. We review the family situation and ask what sorts of problems they've faced in the past. We look for non-verbal clues; what is not said, and what is said without words is important as well," Ms. L'Heureux said.

When the parents feel overwhelmed, the social workers are able to point out how much the parents have going for themselves. "We are constantly reminded of the strength and resilience of families in the face of stress," Mrs. Breslin said. "In the care of families, families are our best teachers."

Some parents are frightened at first because they feel nothing at all. The social workers explain that this is shock — a common reaction to crisis — not callousness. Experience and training make such reassurance far more effective than a well-meant "There, there."

Jane Walker, a graduate social work student here on fieldwork, spoke of one mother whose infant was born with a congenital defect. In telling Jane a family story, the woman laughed aloud — and was suddenly seized with guilt. Jane told her that the crisis would wash over her in waves, and that laughter would help heal her in the lulls when she was up for air.

Like laughter, permission to feel is powerful medicine.

NBSCU Social Work reaches out to the entire family circle, and out beyond the Hospital walls. When a father failed to tell his two-year-old daughter that her mother was in the hospital, giving birth, Ms. Furlong encouraged him to discuss this with his daughter and bring her to the Hospital to visit. The social workers themselves often meet with older siblings to draw forth their feelings on the new arrival.

Often, social workers contact family friends and relatives at the family's request to get emotional support flowing when it has been interrupted by the unexpected aspects of a birth — and to spare parents repeated explanations of the situation they are struggling to absorb themselves.

On a practical level, the social workers provide a wide range of direct and referral services. For instance, finances worry many families, both in terms of immediate Hospital bills and the cost of long-term special care or future surgery. The social workers provide referrals for financial counseling, and make sure that their clients are aware of all the agencies that can offer aid.

Some parents derive great comfort and creative energy through meeting with other families in similar situations; Ms. Furlong and Ms. L'Heureux arrange both parent-to-parent and parent-group meetings.

As time (and each baby) progresses, the entire Unit staff works to help the parents become care-givers prepared to bring their baby home. "While their baby is in the Unit, our guiding philosophy is that parents are our partners in the care of their infants," Mrs. Breslin said. While much of the parent-staff contact in the nurseries involves nurses and physicians, the social workers are always involved behind the scenes.

Every morning, one social worker makes nursery rounds (her partner holds evening office hours for working parents). During these daily rounds the social workers and Unit staff exchange vital information — how babies and parents are doing; how parent-child visits are going — and what can be done to help. No progress is too small to note and support. A simple, "You held your baby well today," from a staff member does wonders for a frightened new parent.

Through the process of daily rounds, the social workers assess the needs of parents they may not see directly, and sensitize the staff to those parental concerns that they have encountered first. A weekly "family care management conference" brings Unit staff and social workers together for a more in-depth review of each family.

On one particular Tuesday morning, the group discussed a baby, ready for "graduation," whose father was at sea in a submarine. They agreed to keep the child until her father could bring her home with the mother, reasoning that this would help the parents get established together, and help the father understand his family's hospital experience. The social workers do everything they can to "make room for daddy" — they've called the submarine base at

J.D. Levine

Groton and talked to some new father's commanding officer more than once.

Another ready-to-go infant was granted an extended stay because his parents were still working out their own problems. "I'm afraid that baby's medical problems were easier to solve than its social problems may be," observed Unit medical director Dr. Joseph Warshaw. The NBSCU will keep healthy, fully-matured babies for a reasonable time if other factors warrant it. When a family's problems are likely to persist, the social workers will arrange nursery home placement, foster home placement, or adoption.

The Newborn Social Work Service is a powerful advocate for babies' well being. Prior to 1965, Connecticut had no codes governing infant nursery operation; the nurseries were run under inappropriate geriatric and convalescent nursing home codes. Mrs. Breslin served on a panel that helped establish the needed codes. The panel also helped develop resources for parents who care for their infants at home or through foster day-care homes.

Everyone on the Unit encourages parents to care for their hospitalized babies as fully and frequently as possible. A logbook lets parents sign in at any hour and jot down questions or comments. "When days go by and we don't see a family's name in the logbook, we're concerned," said Ms. Furlong. With good reason.

Researchers find a disproportionate percentage of premature or birth defective children among those who are neglected or abused. Multiple, complex factors — not yet clearly understood — contribute to this phenomenon. It has been observed, however, that the same infants whose parents seldom visited them in the nursery are those who are later mistreated.

Much of the time, looking out for babies and looking out for their parents is the same thing. One nurse reported to the family care meeting on her successful efforts to help a young mother learn infant care. "That will really help this mother," Ms. L'Heureux told the nurse. "She has been sheltered by *her* mother all her life. Learning how to care for someone is going to mean a lot for her own independence."

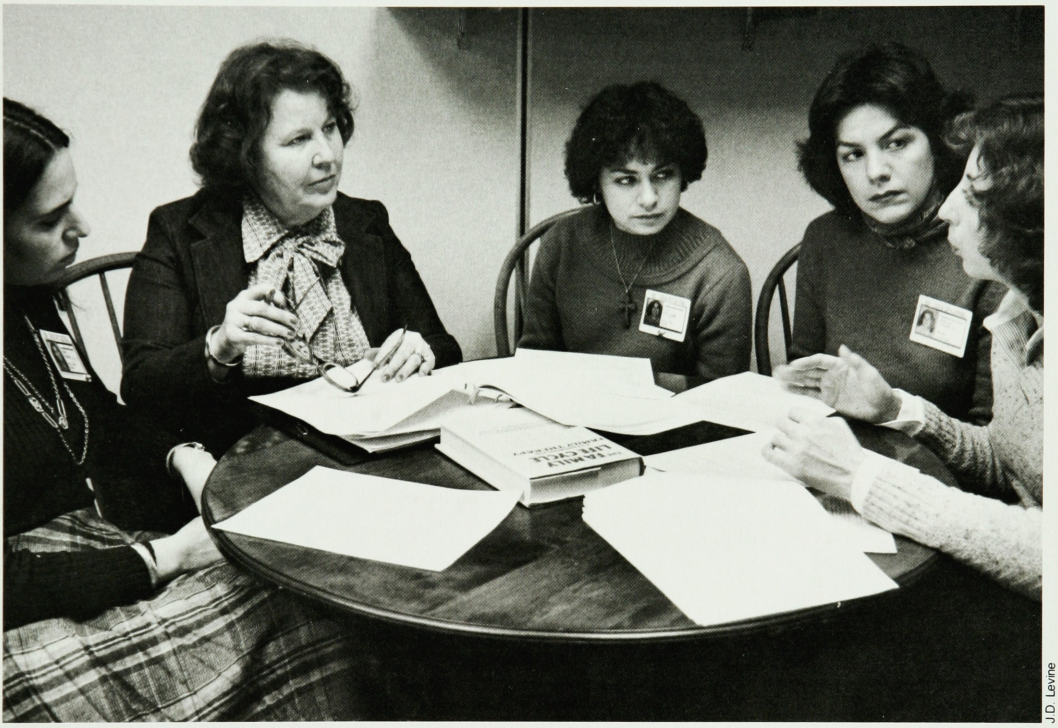
A stranger in this conference room might not readily link speakers with their specialties. Everyone understands the medical, social and emotional issues at hand; moreover, the hierarchy so often evident in medical endeavors is absent here. "There's a great feeling of camaraderie on the Unit," said Mrs. Breslin, "because everyone is involved in touching the lives of individuals and families as they begin."

Like other facets of Yale-New Haven's perinatal program, the NBSCU social work program has been an innovative influence in its field. "Our model has been very well accepted," noted Mrs. Breslin. "It's a great compliment when someone accepts our approach and it becomes their own. In a recent survey of some 200 newborn intensive care units around the country today, social workers — along with physicians and nurses — are providing primary care for the families.

"Here at Yale-New Haven we're also committed to the training of young professionals. Through them, we are treating people we'll never see."

At the heart and start of it has been Mrs. Breslin herself.

"We built on a tradition of family-centered maternity care that began here," Mrs. Breslin remarked. "Back in the 1940's, a Yale pediatrician and analyst, Dr. Edith Jackson, introduced rooming-in. Before that it was almost unheard of.



J.D. Levine

Making social work work well involves program planning and coordination in addition to individual expertise. Here, members of the perinatology social work staff meet with Ruth Breslin (second from left), Director of Social Work in Obstetrics, Gynecology, and Perinatal Medicine. From left to right: Andrea Seigerman works with 19-to 22-year-old mothers, including high-risk mothers. Hilda Perez is involved with the Young Mothers Program for mothers 18 years old and younger and counsels Spanish-speaking high-risk mothers of all ages. Jacqueline L'Heureux's exclusive charge is caring for families of NBSCU babies. Regina Furlong divides her time between NBSCU families and high-risk mothers.

"When there is a basic objective, perceptions of care are filtered through this objective and one makes planning and program decisions which support it. From the beginning we could see that to care for *families*, the Unit had to be open to families 24 hours a day, have direct phone lines, provide physical and emotional space for parents to be with their babies, and so on. But you can't stop at that — you have to continue looking at all the aspects of family care, beginning the moment the family enters the perinatal system of care. Indeed — even before."

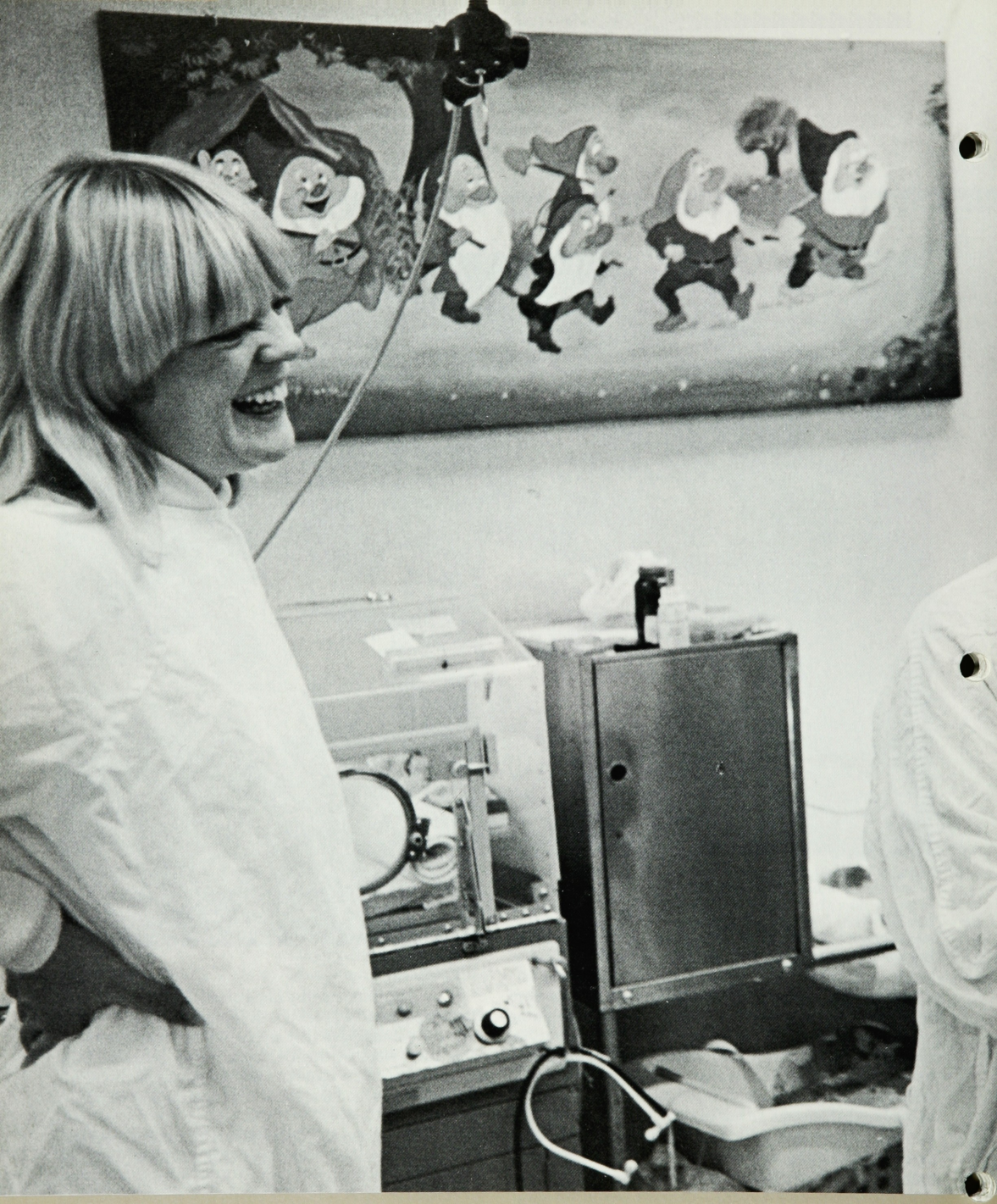
At the time the Unit opened, the state would not allow child visitors. Mrs. Breslin had a window onto the nursery installed in her office so that children could stand on a stool and see their newborn siblings.

To help parents absorb a flood of new information, Mrs. Breslin prepared a brochure explaining NBSCU medical terms. As it emerged that staggering newborn intensive care costs were in themselves a family problem, Mrs. Breslin initiated a cost-data compilation which contributed to broadened insurance coverage for sick newborn care.

Mrs. Breslin reveals these deeds with some reluctance, focusing instead on the never-ending needs she works to meet.

"How often does it happen that a new field of medicine like perinatology develops, and you're there in a position to be a part of it?" she mused aloud. "I feel I'm very lucky."

YNH



Annual Report 1980

COMPARATIVE STATISTICS

GENERAL INFORMATION	1980	1979
Number of Patients	35,735	35,581
Patient Days Care Provided	275,315	273,506
Average Length of Patient's Stay (Days)	7.7	7.7
Average Daily Patient Census	752	749
Births	5,077	5,107
Outpatient Clinic Visits		
Primary Care Center	33,024	31,712
Other Clinic Visits	157,389	153,315
Total Clinic Visits	190,413	185,027
Emergency Service Visits	89,494	90,623
Total Outpatient Visits	279,907	275,650
Volunteer Hours Donated	76,437	85,723

INPATIENT STATISTICS — DISCHARGES	1980	1979
Adults		
Medical	17,232	17,065
Surgical	9,415	9,805
Total Adults	26,647	26,870
Pediatrics		
Medical	2,458	1,856
Surgical	1,260	1,419
Total Pediatrics	3,718	3,275
Newborn		
Regular	4,435	4,396
Special Care	935	1,040
Total Newborn	5,370	5,436
Total Inpatient	35,735	35,581

NEWBORN STATISTICS

	1980	1979
Live Births	5,077	5,107
Stillbirths	44	52
Low Birth Weight (under 2500 grams)	492	488

NEWBORN SPECIAL CARE UNIT

Total Admissions	1,143	1,200
Male	647	637
Female	496	563
Born In-house	906	957
Transferred from Other Hospitals	237	243
Neonatal Deaths	104	97
Total Average Length of Stay	11.2 days	NA
for Transfers	15.5 days	NA
Non-transfers	10.4 days	NA
Age at Admission		
Day of Birth	753	760
1-2 Days of Age	129	120
3-7 Days of Age	180	167
Over 7 Days	81	153
Gestational Age In Weeks		
25 or less	31	20
26-28	58	46
29-31	70	69
32-34	178	180
35-37	233	250
38-42	541	594
43 or more	14	13
Age not recorded	18	28
Total Premature Births	564	565
Birthweight		
599 grams or less (1 lb. 5 oz.)	16	9
600-999 grams (1 lb. 5 oz.-2 lb. 3 oz.)	57	45
1000-1999 grams (2 lb. 3 oz.-4 lb. 6 oz.)	243	244
2000-2999 grams (4 lbs. 6 oz.-6 lbs. 10 oz.)	357	403
3000-4000 grams (6 lbs. 10 oz.-8 lbs. 13 oz.)	374	418
Over 4000 grams (8 lbs. 13 oz.)	73	64
Weight not recorded	23	17

YALE-NEW HAVEN HOSPITAL STATEMENT OF REVENUES AND EXPENSES OF UNRESTRICTED FUND ($000's OMITTED)

	Year Ended September 30 1980		1979	
REVENUE FROM SERVICES TO PATIENTS				
Room, Board and Nursing	$47,387		$43,770	
Special Services — Inpatients	50,699		44,878	
Clinic Patients	5,452		5,282	
Emergency Room Patients	5,007		4,865	
Referred Outpatients	9,302		8,415	
Total		**$117,847**		**$107,210**
Deductions from Gross Revenue				
Contractual and Other Allowances	11,620		10,859	
Provision for Uncollectible Accounts	4,016		4,876	
Total		**15,636**		**15,735**
Net Revenue from Services to Patients		102,211		91,475
Other Operating Revenue		212		271
Total Revenue		**102,423**		**91,746**
OPERATING EXPENSES				
Salaries	54,725		49,139	
Supplies and Other Expenses	52,681		46,372	
Depreciation	3,054		2,707	
Interest	394		624	
Total	**110,854**		**98,842**	
Less — Recovery of Expenses from Grants, Tuition, Sale of Services, etc.	(8,292)		(7,299)	
Net Operating Expenses		102,562		91,543
Operating Gain/(Loss)		(139)		203
NON-OPERATING REVENUE				
Investment Income	1,661		1,125	
Interest	29		63	
All Other	(34)		(80)	
Total		**1,656**		**1,108**
Excess of Revenues Over Expenses		$1,517		$1,311

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Consulting	47
Emeritus	38
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Courtesy	96
Adjunct Physicians	8
Dentists and Physicians to the Ambulatory Service	217
Clinical Fellows	106
Residents	335
Professional Staff (non-M.D.)	49
(less duplications) (-13)	
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*In this total are 365 full-time physicians including those with offices at the Veterans Administration Hospital and the Connecticut Medical Health Center who hold Yale-New Haven Hospital Medical Staff appointments.

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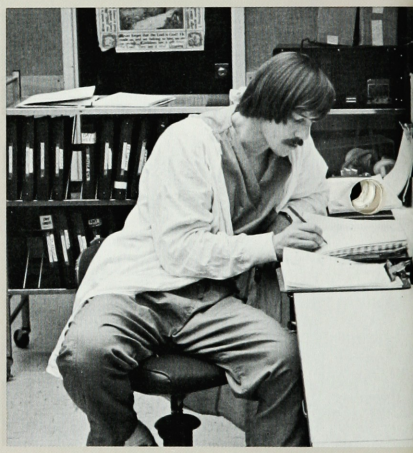

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