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FOREWORD

In recognition of the number of suspicious child injuries and deaths, the Illinois Department of Children and Family Services and the Cook County Medical Examiner jointly formed a statewide task force to develop professional guidelines on child death autopsies and child injuries.

We believe that concerned professionals should continuously improve their skills, develop new tools, and standardize and share those advancements with others in the professions.

With the excellent help of the task force experts, these guidelines have been prepared for your use. We hope you will find the contents helpful.

Gordon Johnson, Director
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Robert J. Stein, M.D.
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ACKNOWLEDGEMENTS

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Appreciation is expressed to the Taylor Institute, who through its convenor, Dr. Larry Hall, and staff person, Dr. Marshall Rosman, kept the work of the Task Force running.

With the tremendous commitment to the work of the Task Force and the time so freely given to the effort by all its members, a special thanks is expressed to each and every member of the Task Force. It is our expressed hope that the working relationships of so many agencies will proceed into the future and continue to develop more effective tools such as the protocols on child death and accidental injury. Such efforts will enable professionals to more effectively deal with problems resulting from child abuse.

Finally, we want to acknowledge the assistance of the Illinois State Medical Society in producing and distributing this protocol on behalf of the Illinois Department of Children and Family Services.

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INTRODUCTION

Child abuse and neglect are significant problems that involve the entire medical community. The purpose of this protocol is to provide guidelines for establishing a uniform standard for the performance of suspected child abuse/neglect autopsies throughout the State of Illinois. It is expected that a complete autopsy will be performed on all children whose deaths are sudden, unexpected and/or not due to obvious natural causes. The cause and manner of death may be apparent at autopsy, but frequently these decisions will need to be deferred until all medical records and investigative reports are reviewed and special studies are completed. Consultation with other medical and non-medical specialists is often necessary and is encouraged. In cases of abuse or neglect, the involved parties may attempt to conceal the true circumstances and mechanism of injury. On the other hand, accusations of abuse of neglect may prove to be unfounded. The personnel responsible for conducting the investigation must collect their evidence carefully and present their conclusions in a clear manner with the evidence necessary to support their conclusions.

There are six major patterns of child abuse: 1) physical abuse; 2) nutritional deprivation; 3) sexual abuse; 4) intentional poisoning or drugging; 5) neglect of medical care or safety, and 6) emotional abuse. It must be understood that frequently the only evidence available will be the results of the autopsy examination. The pathologist must be aware that he or she will be responsible for answering questions that may bear on any of the above forms of abuse:

1. Was death due to neglect, injury, or from complications of neglect or injury?
2. Did a delay in seeking medical care contribute to death; if so, was this an "unreasonable" delay?
3. If related to injury, what was the mechanism of injury?
4. Was the injury consistent with the alleged mechanism of injury; if not, why not?
5. When did the injury occur in relation to the time of death?
6. Did death result from a single episode of injury or as the result of multiple episodes of injury?
7. Were drugs or poisons involved in the death?
8. If neglect was involved, what form did it take?
9. If there has been failure to thrive, was this due to metabolic disorder, other disease, or neglect?
10. To what extent did environmental, nutritional, and social factors contribute to death?

FACILITY

The autopsy must be performed in a properly equipped forensic facility or hospital autopsy suite. Where possible, x-ray and fluoroscopy should be available on site. A funeral home is not the appropriate place for the practice of medicine. The body must not be embalmed prior to autopsy.

PERSONNEL

The autopsy should be performed by a pathologist experienced in forensic pathology, preferably Board certified in this specialty.

A pathologist who does not routinely deal with death related to injury may lack the necessary experience to interpret the mechanisms of injury in child abuse cases. The following consultants should be available as needed:

1. Experienced forensic odontologist
2. Pediatric radiologist
3. Neuropathologist
4. Pediatrician and pediatric subspecialists
5. Forensic anthropologist
6. Pediatric pathologist

In view of the limited number of such persons throughout the state, a referral list of regional resources can be found in Appendix G.

PHOTOGRAPHY

Color photography (preferably 35mm transparencies) with proper color balance to assure faithful reproduction of lesions is necessary. A ruler and identifying tag should be present in all photographs. It is important that an organized system of photography be in place. Photography by trial and error will not succeed. The body should be photographed as it is received and after it has been cleaned. Photographs of the entire body, various anatomic regions of the body and of individual lesions should be taken.

INVESTIGATION

1. *Review of Records*

   Prior to beginning the autopsy all records that are available should be reviewed and all further records that are necessary should be ordered. These records would include all investigative reports, DCFS records, police reports, paramedic reports, emergency room records and the previous hospital and/or physician's records, including results of laboratory examinations and x-rays. Medical insurance records might be useful in providing information on previous illness, accident, or medical treatment.

   The medical record is likely to be incomplete due to the emergency situation facing a physician when a severely ill or injured child is brought to

the hospital. It is important to discuss with the attending physician, as soon as possible after the death of a child, his or her recollection of not only the injuries but the general clinical status, history, and family situation. The physician should also be queried with regard to resuscitation performed.

2. *Family History*
   Prior to the autopsy, the pathologist should obtain as much of the child's personal history and family history as possible. This should include developmental, medical and social history. This history may give important clues to findings at autopsy and their interpretation. More often than not, this information will be obtained by medical personnel, DCFS investigators or police officers.

3. *Agency Investigation*
   It is important to have an open line of communication between those agencies responsible for investigation, cause and manner of death determination, and possible prosecution. The medical examiner/coroner, police, DCFS and State's Attorney should keep each other informed, share data and otherwise cooperate in all stages of the case, as appropriate for each agency. This is further discussed in Apendix B.

4. *Scene Investigation*
   A scene investigation by the pathologist is often essential in evaluating mechanisms of injury. Furthermore, the home environment including cleanliness, safety hazards, neighborhood, pets, quantity and quality of food, medications, etc., may provide important information in making the cause/manner of death determination.

THE AUTOPSY

I. GENERAL EXAMINATION

1. *Confirm identification, if known.*
   An identification tag should be attached to the body. Identification can be confirmed by a relative or other person who knew the child. If the identification of the child is unknown, footprints should be obtained at the completion of the autopsy. If the body is decomposed or skeletalized, dental, radiologic or anthropologic identification will be necessary.

2. *Identification of photographs.*
   As described above, photographs are an essential part of the autopsy record and should be used to document all of the injuries to the child. Each photograph should have a ruler and identification tag present. There should be one photograph of the face for later identification purposes in court. The photographs should systematically cover each region of the body. Individual lesions or groups of lesions must be photographed at close range. A normal focal length lens is not sufficient for proper autopsy photography. A macro lens is essential. Available room light will not provide proper color balance. Either flash or photoflood light must be used, each with the film that will provide proper color balance. Several Kodak publications provide guidance for setting up a photographic facility.

3. *Examination of clothing and all items accompanying body.*
   It is essential that the body be brought to the autopsy suite with the clothing and other associated items undisturbed. The police must be discouraged from removing the clothing at the scene. The clothing and other personal items should be examined and described. This examination should be done in the presence of an evidence technician from the crime laboratory of the appropriate police jurisdiction. Tears, blood stains, and the general cleanliness of the clothing should be described.

4. *Search for trace evidence.*
   A search should be made for hairs, fibers, or other trace evidence that may be on the body or clothing. As appropriate, these should be removed prior to removal of the clothing, identified and given to the crime laboratory evidence technicians. The clothing should subsequently be removed and the body again searched for trace evidence. If there is suspicion of sexual abuse, oral, rectal and vaginal swabs should be taken for antigenic typing of semen and/or microbiological studies as appropriate. The technique to be used should be established in consultation with crime laboratory personnel. Swabs of bite marks should be taken. These specimens must be obtained prior to washing the body. Preservation of bite mark evidence is described further in Appendix F.

5. *Radiologic skeletal survey.*
   A complete skeletal survey must be done prior to the start of the autopsy, and the films must be available for review during the autopsy. Instructions for radiologic examination are contained in Appendix C.

II. EXTERNAL EXAMINATION

In addition to photographs of the body, body charts, and diagrams should be prepared to document essential findings at autopsy.

1. *General Appearance*
   The general appearance of the child should be documented. This should include height and

weight, body stature, the presence or absence of rigor mortis, and the locations of post mortem lividity if it is present. A general description of the body as appropriate in any autopsy should be given.

The time of death usually cannot be accurately determined. Although drop in body temperature, rise in vitreous potassium and other post mortem events may give an approximation of the time of death, there are so many biological variables present in such a determination that it is prudent to be circumspect in one's opinion.

2. *Cleanliness*
Is the child's skin clean? Is there dirt present in skin folds? Is this an acute or chronic status? Poor hygiene may be manifested by severe chronic diaper rash, lichenification of the skin and chronic seborrhea.

3. *Nutrition*
Nutritional assessment of the child can be made by comparing its height and weight to standard growth curve charts. Head circumference, chest circumference, and abdominal circumference should be measured. Poor nutrition or growth retardation reflects a chronic condition. Further information on nutritional assessment is provided in Appendix E.

4. *Dehydration*
Is dehydration present? In young infants, the fontanelles may be depressed. Sunken eyes, poor skin turgor, and dry mucosal membranes are indicators of dehydration. Vitreous humor electrolyte analysis may show an elevated urea nitrogen and sodium level. Dehydration usually reflects an acute condition.

5. *Failure to Thrive*
This may be due to metabolic disorders, congenital anomalies or chronic disease. Chronic abuse, nutritional deprivation and emotional neglect can also cause failure to thrive. Children whose failure to thrive is on an organic basis are more likely to be abused or neglected.

6. *Congenital Anomalies*
Is there evidence of any congenital anomalies? Are there manifestations of a genetic disorder or of fetal alcohol syndrome?

7. *Any Evidence of Neglect/Abuse*
If the child is normal size for age, shows no evidence of dehydration or poor hygiene, and has no evidence of cutaneous or sexual injury, then this should be mentioned as an essential negative finding.

8. *Evidence of Sexual Abuse*
If there is no physical evidence of sexual abuse then this should be recorded as an essential negative finding. If there is evidence of sexual abuse, this should be described under evidence of injury to the perineal region, rectum and genitalia.

9. *Evidence of Bite Marks*
If injuries suspicious of bite marks are present, a forensic odontologist should be consulted prior to proceeding with the autopsy. Failure to observe this rule may cause irretrievable loss of evidence. The skin should not be washed prior to examination of the bite marks, since this will prevent attempts at recovery of dried saliva for evaluation. Bite marks should not be excised since any attempt will produce tissue distortion.

III. EVIDENCE OF EXTERNAL INJURY

Child abuse injuries may be numerous, of different ages, produced by a variety of blunt trauma and other forms of injuries and involve many parts of the body. As a result, describing child abuse injuries can be tedious and confusing to the reader of the protocol, if the description is not given in some organized tabulated form. This can be done by separately describing external injuries and internal injuries, by breaking down the description of injuries into various anatomic regions of the body, and by separately describing recent injuries, healing injuries, and healed injuries.

1. *Recent Injuries*
These are often best described by anatomic region. The type of injury (contusion, abrasion or laceration) should be identified and dimensions given.

In suspected beating cases, lengthwise incisions through the skin and subcutaneous tissues of the involved anatomic regions should be made to determine the depth to which hemorrhage extends. This provides an indication of the severity of the blunt force used and may also reveal significant soft tissue injury not apparent from examination of the skin surface.

If the injury is patterned. a description of the pattern should supplement the photograph of the injury. Sections through representative lesions should be taken for microscopic examination.

2. *Healing Injuries*
These should be described in a manner similar to the description of the recent injuries. Sections of representative injuries should be taken for microscopic examination.

3. *Healed Injuries*
   The pattern of scars is frequently characteristic of the type of implements used to produce the injuries. Scars should be recorded in a manner similar to description of other injuries.

IV. EVIDENCE OF INTERNAL INJURY

These injuries are often best described by anatomic region. It is important to attempt to date the injuries both grossly and by microscopic examination. Where possible, internal injuries should be correlated with external injuries.

V. EVIDENCE OF SKELETAL INJURY

This description should be based both on x-ray examination and direct examination. Again, it is important to attempt to determine the age of the various lesions. A formal consultation report should be included.

VI. EVIDENCE OF RESUSCITATION

Evidence of resuscitation must be described. Direct injection of epinephrine into the heart may produce pericardial hemorrhage. Lesions such as rib fractures, intra-abdominal hemorrhage, liver lacerations, and other internal injuries should be presumed as not due to resuscitation unless proved otherwise. Even vigorous resuscitation in a young child will rarely, if ever, produce these injuries.

VII. EVIDENCE OF THERAPY

Prolonged hospitalization may obscure evidence of injury and even brief hospitalization and therapy may alter the appearance of injuries. All findings related to therapy should be described.

VIII. INTERNAL EXAMINATION, GENERAL

This examination should mention important positive and negative findings regarding the neck, organs of the chest and organs of the abdomen in regard to antecedent disease or abnormality.

IX. SYSTEMS REVIEW

Each organ system should be described separately as with a usual medical autopsy. Special procedures include dissection of the posterior neck region in suspected shaken baby autopsies. It may also be necessary to remove the eyes to examine for evidence of retinal hemorrhage.

X. MICROSCOPIC EXAMINATION

This should include sections of representative injury sites as well as routine sections of internal organs. The injury process evolves much more rapidly in young children than in adults, and this must be considered when dating the age of injuries. The usual time required for resolution of an injury may be affected by the child's state of nutrition, intercurrent infection and coma.

XI. SPECIAL STUDIES

1. *Post Mortem Chemistry*
   Vitreous humor, should be saved for appropriate electrolyte and chemistry studies. Serum and CSF should also be saved, as necessary.
2. *Toxicology*
   Samples of blood, bile, urine, and gastric contents should be saved for toxicologic analysis. Where unusual drugs or poisons are suspected other tissues should be saved as appropriate.
3. *Microbiology*
   Where appropriate, specimens of blood, lung, brain. or other tissues should be taken for culture.
4. *Neuropathology*
   The brain should be fixed in formalin and dissected after fixation in cases where head injury is apparent or suspected.
5. *Other Studies*
   Other types of studies should be considered as appropriate.

XII. PATHOLOGIC DIAGNOSES

The pathologic diagnoses should be listed in a clear and concise manner. They should be tabulated so as to be understandable to persons without a medical background.

XIII. COMMENT OR OPINION

A brief comment or opinion based on a correlation of history, investigative reports, autopsy findings, and laboratory studies should indicate the cause of death and the manner of death. Frequently, the final opinion in the case must be deferred until after consultation with other involved agencies and a group discussion of the facts in the case. If a decision cannot be reached regarding the cause and/or manner of death, then the death certificate will indicate these to be undetermined. This represents the opinion of the medical examiner/coroner based on all of the information available to him or her. It is not binding on the State's Attorney or DCFS.

APPENDIX A

SUGGESTED DOCUMENTATION

I. *The Autopsy Protocol*
   1. Written in clear, concise language, understandable by laymen (lawyers, judges, police, etc.).
   2. All injuries enumerated individually, not described in paragraph form.
   3. Pathologic diagnoses.
   4. Opinion regarding cause of death.

II. *Photographs*
   1. All body surfaces.
   2. All external injuries labeled with case number and date. Include ruler, orientation view and close-up; hair may have to be shaved to expose wounds.
   3. Bruises, after incision into wounds.
   4. Internal injuries.

III. *Body chart prepared by pathologist*

IV. *X-Rays and radiologist's report*

V. *Investigative Reports*
(Medical Examiner/Coroner investigator, DCFS, hospital and physician records; police reports; paramedic reports, E.R. records)

VI. *Scene investigation with photographs of environment by police, medical examiner/coroner, or DCFS*

APPENDIX B

INTERAGENCY COLLABORATION

Developing good working relationships among personnel from principal agencies is critical to the investigation process as well as to the effectiveness of the roles performed by each of the participating agencies. Important interacting agencies include local law enforcement, Department of Children and Family Services, and the Coroner or Medical Examiner's Office. Smooth working relationships among so many agencies do not come about easily and require considerable effort.

1. To begin with, key agencies within each locale should be identified as the "principals" involved in most abuse cases.
2. Agency personnel must develop an understanding of the unique roles and functions of the other agencies. This can take place informally or by means of structured mechanisms.
3. The Department of Children and Family services has appointed several regional multidisciplinary committees throughout the State of Illinois to assist the Department in dealing with complex cases of abuse and neglect. These committees can become the vehicles for education concerning the roles and functions involved in death investigations.
4. It is recommended that every child death case reported as a homicide by a Medical Examiner or coroner and every case of severe injury to a child reported by a medical facility be reviewed by a "case conference" involving all principal agencies when the Department's (DCFS) own investigation has not produced sufficient "credible evidence" to warrant "indicating" the case.
5. Case conferencing among principal agencies is also recommened in the rare instance where the perpetrator of death or severe injury is a child.
6. Where feasible and appropriate, the safety of surviving and future siblings can be enhanced by notifying and/or involving the family's primary care physician.

ROLES AND DECISIONS OF PRINCIPAL AGENCIES

Any child death thought to have resulted from accident, abuse, neglect, or homicide must be reported to appropriate legal authorities:

* Local police departments;
* Department of Children and Family Services;
* Coroner or Medical Examiner's Office

For some counties within the State of Illinois, reciprocal agreements regarding notification procedures have been specified, e.g., when a suspected case of fatal abuse is reported to the abuse hotline, the local police department is notified by the worker at the Central Registry. In other instances, the police Department immediately notifies the Central Registry when they are called in on a case involving suspected abuse.

During the autopsy process, police collect data, take photographs, and have the responsibility for ensuring "continuity or chain of custody of evidence."

It is recognized that to establish abuse or neglect on a child at autopsy, the pathologist or medical examiner must determine the cause of death

documenting all injuries whether they resulted in whole or in part from physical abuse, neglect, or accident.

In the DCFS "Child Abuse and Neglect Investigation Decision Handbook," in a section on roles and responsibilities, ". . . a child abuse/neglect investigation is defined as a fact-finding process the purposes of which are (in order of importance):

* to assure the safety and well-being of children (e.g., surviving siblings) suspected to be abused and/or neglected;
* to determine the validity of reported allegations;
* to obtain sufficient information to support Department decisions in court (if necessary);
* to give service delivery staff adequate information on "indicated" reports to determine if services are appropriate or necessary to ameliorate family dysfunction."

With the information provided by the coroner or medical examiner, the local police department and the Department of Children and Family Services notify the State's Attorney's Office. In that office, the decision is made as to whether to prosecute individuals suspected of causing a child's death or inflicting serious injury.

RANGE OF RELEVANT INFORMATION

While there are a number of sources for gathering potential relevant information about a family, three important areas need to be highlighted because of their direct bearing on the success of child injury and death investigations.

The areas include information from paramedics and private ambulance companies; data from other medical professionals, e.g., emergency room hospital records and other out-patient medical personnel; and records kept on file by local police departments and the Illinois Department of Children and Family Services.

Paramedics are often the first professional staff on the scene. Their observations and reports can be critical to the investigation process, contributing information about the injured, the surrounding environment and verbal exchanges among family members, witnesses and others. Any form of treatment administered by paramedics during transport is reported and monitored. The nature of the treatment may be important in reaching a decision about the cause of the injuries.

Information pertinent to diagnosis and treatment conducted in the hospital *emergency room* also provides important facts that guide the medical examiner in reaching a conclusion about the cause of death. Obtaining medical history from health professionals, e.g., hospital and clinics, can also do much to clarify the decision reached by the pathologist or medical examiner.

It is important for the investigator to specifically request all documents relevant to the case. It has been shown that requesting information from the medical records department of a hospital may not result in delivery of data covering paramedic or emergency room treatment. Paramedic records may also be subpoenaed from the local fire department or ambulance company.

Finally, the police history of a suspected perpetrator and whether the family has had previous contact with the Department of Children and Family Services, or other community services provide important perspectives on what the Medical Examiner may uncover through the autopsy. It also may be critical in the decision-making process regarding prevention of harm to other family members.

APPENDIX C

RADIOGRAPHIC GUIDELINES FOR SUSPECTED CHILD ABUSE

I. *RADIOGRAPHIC VIEWS FOR SUSPECTED CHILD ABUSE DURING POSTMORTEM EXAMINATIONS*

A. AP and lateral skull.

B. AP torso, to include chest, abdomen and pelvis, with penetration adequate to visualize the posterior ribs.

1. For these anatomical areas, a single film is used. Usually a single 14 x 17 accommodates these areas. Occasionally multiple films may be needed.
2. Decubitus views of the chest may be helpful when there is the possibility of pneumothorax.
3. The decubitus view and/or crosstable view of the chest are additional views useful for diagnosing pneumomediastinum and pneumothorax.
4. In cases of possible perforated viscus, free air in the abdominal cavity can be detected with a 10-minute abdominal film in the upright position or left lateral abdominal decutibus film.

C. AP of the Upper and Lower Extremities

Arms and forearms should be done individually. Because of postmortem flexure contractures, views of the hands and feet are not routinely done.

D. Extremity Joints

Right and left shoulder, elbow, wrist, hip, knee and ankle. Individual AP views of these joints with centering over each joint.

E. Lateral View of the Entire Spine

Individual views of the cervical, thoracic and lumbar spine are best for detail. Multiple exposures on a single 14 x 17 film can be done. A cone down view of the cervical spine may be necessary.

F. Other Studies

Sometimes fractures, especially rib fractures, cannot be identified on preautopsy films. Injuries discovered during autopsy are subsequently radiographed. Sometimes it is best to remove the skeletal part for radiographic examination.

II. *DIAGNOSIS OF SKELETAL INJURIES DUE TO MALTREATMENT*

A. Age

1. Usually not immediate neonatal period
2. Majority under 2 years of age

B. Fifty percent fail to show evidence of skeletal injury, but show evidence of soft tissue injury: bruises, scars, and burns, etc.

C. Fractures

1. Epiphyseal-Metaphyseal (E-M) Injuries
   a. Typical Salter-Harris I and II
   b. Bone architecture and mineralization usually normal and this differentiates it from dyplastic, metabolic and hematologic fractures.
2. Diaphyseal Fractures: Transverse or Oblique
   a. As common and as typical as E-M fractures
3. Rib Fractures
   a. Common
   b. Difficult for children to obtain other than by abuse. Be very suspicious without documented evidence of direct blow or crush injury, i.e., auto accident.
   c. Location: posterior, lateral or anterior
      1) Posterior and lateral fractures show abundant callus
      2) Anterior fractures show exaggerated cuffing of costal chondral junction
4. Skull Fractures
   a. Etiology: direct blow
   b. Type
      1) Linear
      2) Diastatic (split suture) secondary to intracranial bleeding or subdural hematoma
5. Highly Suspicious Injuries
   a. Fracture of distal end of clavicle
   b. Fracture of anterior ribs (see above)
   c. Fracture of the scapula

D. Dating Injuries

1. Less than 10-14 days: soft tissue changes only. Minimal or no signs of healing.

2. 2-4 Weeks: callus and periosteal new bone deposition is evident. Periphery calcifies, center lucent. Radiolucent space between bone and callus.

3. 4-12 Weeks:

   a. May still see underlying fracture

   b. Callus mature, smooth and uniformly dense

4. After 12 Weeks:

   a. May see only thickened cortex

   b. Fracture line disappears

E. Intrauterine Abnormalities

1. Bowing: prenatal

   a. Etiology: abnormal fetal position

   b. Oligohydramnios

   c. Soft bones

      1) Osteogenesis imperfecta

      2) Hypophosphatasia

   d. Camptodwarfism

2. Congenital dislocated knee

   a. Etiology: faulty intrauterine position

F. Birth Trauma: Most fractures of newborn period occur during delivery.

1. Clavicle

   a. Most frequently fractured

   b. Location:

      1) Most common mid-clavicle, but can occur at either end.

2. Long Bones: next most common

   a. Location:

      1) Diaphysis of epiphyseal-metaphyseal junction (Slater-Harris I and II)

      2) Ends of humerus and proximal femur

   b. X-Ray: Initially soft tissue swelling; can't see epiphysis as epiphysis not ossified.

      1) Dislocated joint in neonate rare. Think epiphyseal fracture.

      2) Corner fracture

3. Rib Fractures

   a. Premature prone to rib fractures 4-8 weeks postparturition; often secondary to calcium deficiency or rickets.

G. Differential Diagnosis—Birth Injury vs. Abuse

1. Birth injuries show callus between 7-11 days.

2. Fracture visible after 11 days without signs of callus or subperiosteal bone deposition should *not* be considered related to birth.

3. Osteogenesis imperfecta tarda may be present in newborn period.

4. Fractures caused by birth trauma:

   a. Skull fracture

   b. Midclavicular fracture

   c. Humeral fracture

   d. Femoral fracture

   e. Femoral epiphyseal fracture—separation

III. *DEPRIVATION DWARFISM*

Deprivation or psychosocial dwarfism is a temporary nutritional disorder resulting in the state that simulates pituitary dwarfism. When a child begins taking nutrition, there is rapid growth of the body. The rapid growth of the brain may result in split sutures simulating increased intracranial pressure. These children usually do not have fractures. There are many growth rest lines which help differentiate them from pituitary dwarfism.

IV. *SUMMARY OF INJURIES DETECTED BY RADIOGRAPHIC TECHNIQUES*

A. Injuries Highly Suggestive of Abuse†

- Isolated long-bone fracture*
- Corner fracture
- Acrominal fracture
- Scapular fracture
- Sternal fracture*
- Multiple rib fractures
- Multiple costovertebral fractures
- Incidental compression fracture of the spine*
- Multiple costochondral fractures
- Pancreative pseudocyst*
- Duodenal hematoma*
- Hepatic laceration or hematoma*

- Mesenteric laceration*
- Bowel rupture*
- Cerebral contusion*

* In absence of convincing history of accidental trauma

B. Injuries That Are Worrisome But Are not Diagnostic of Abuse†
   - Isolated fracture-separation of distal humeral epiphysis
   - Distal clavicular fracture
   - Single rib fracture
   - Metatarsal or metacarpal fracture
   - Unexplained cerebral atrophy or hydrocephalus

C. Common Accidental Trauma†
   - Midclavicular fracture
   - Distal radiotorus fracture
   - Skull fracture
   - Spiral tibial fracture (toddler's fracture)
   - Amputation or crush injury of distal phalanges

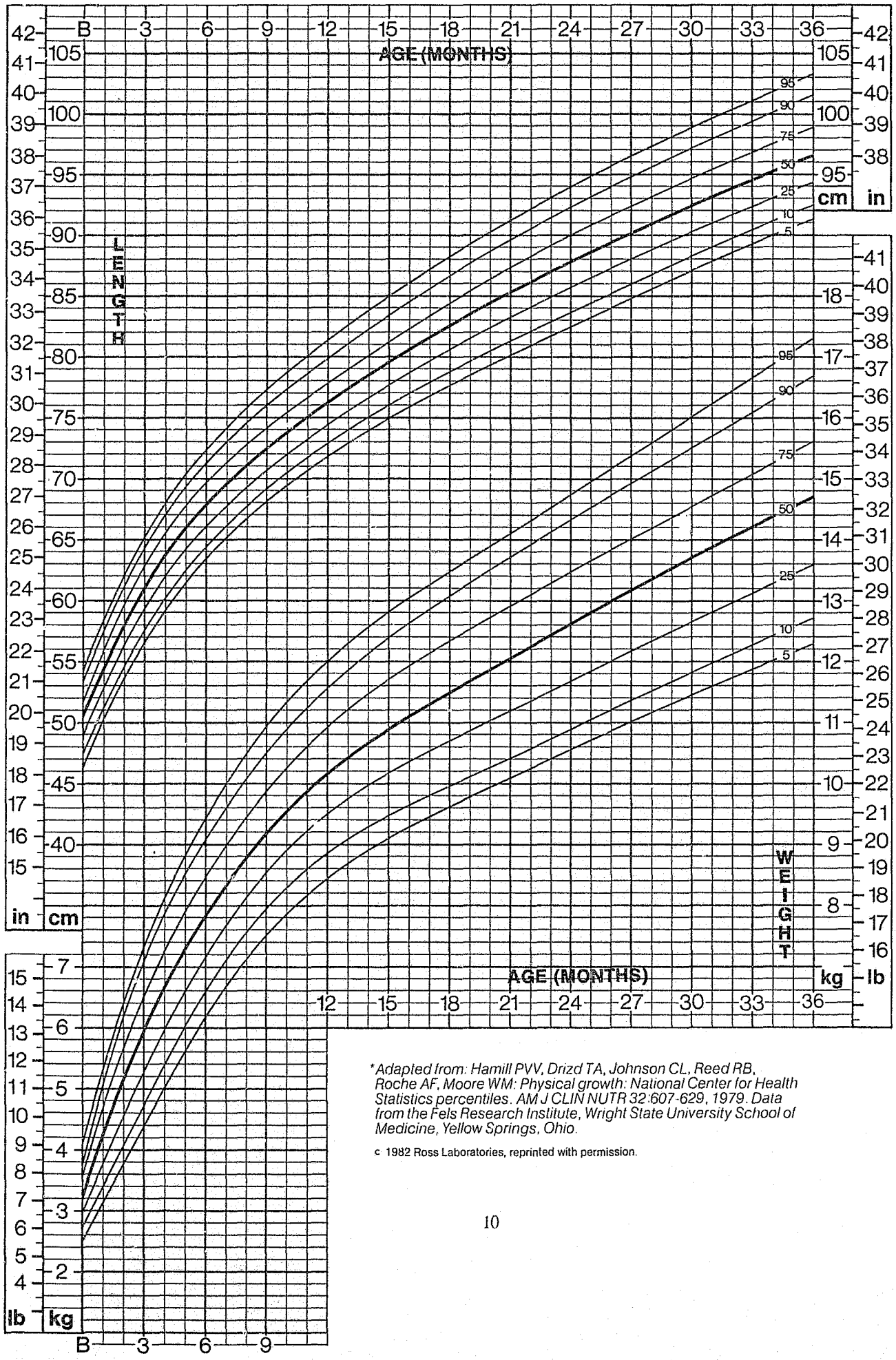
D. Most Common Fractures Caused by Birth Trauma†
   - Skull fracture
   - Midclavicular fracture
   - Humeral fracture
   - Femoral fracture
   - Femoral epiphyseal fracture-separation

†*Hilton SVW, Edwards DK. Radiographic diagnosis of non-accidental trauma. Applied Radiology 14:13-24, 1985.*

APPENDIX D

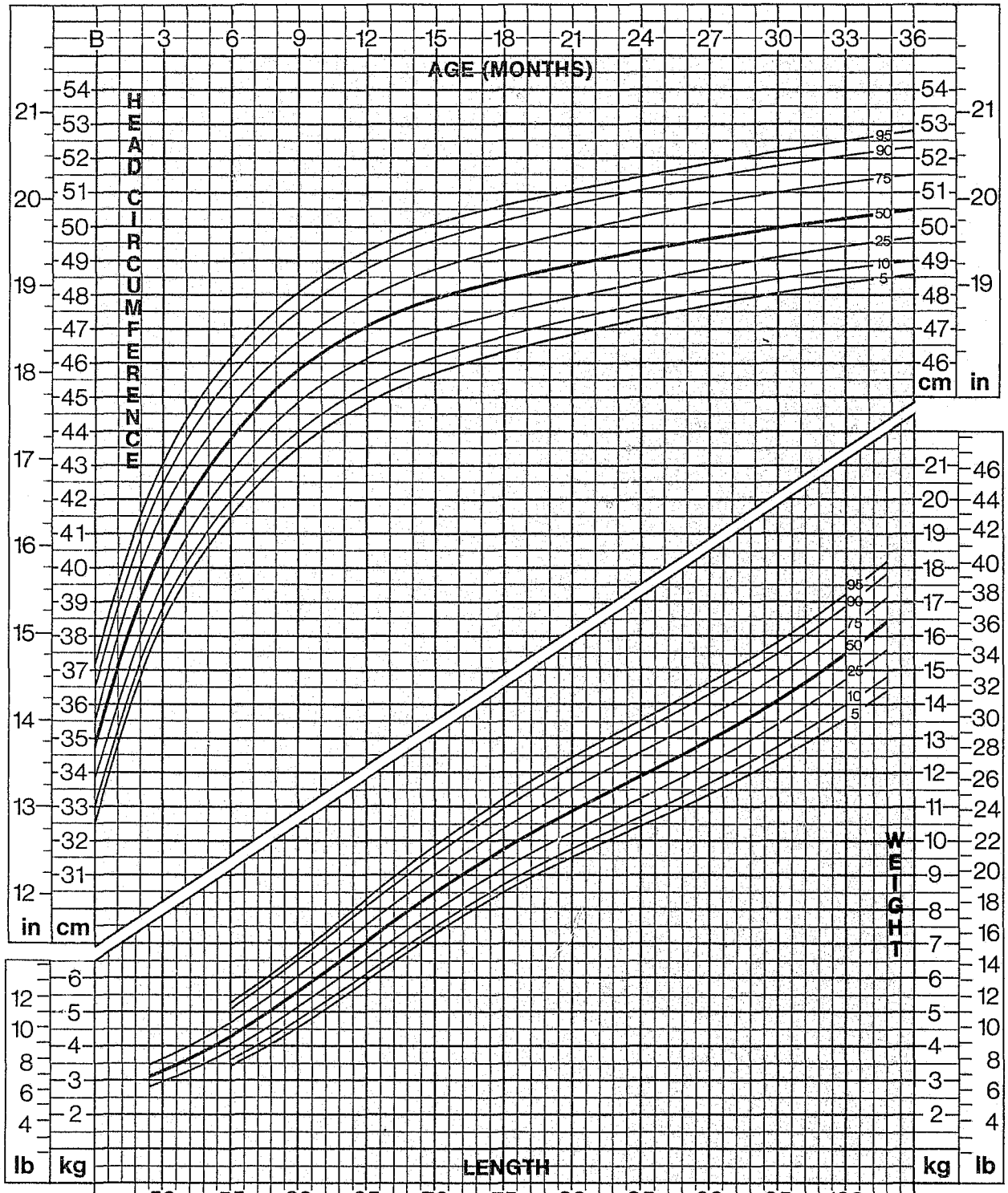
PHYSICAL GROWTH CHARTS

BOYS: BIRTH TO 36 MONTHS
PHYSICAL GROWTH
NCHS PERCENTILES*



*Adapted from: Hamill PVV, Drizd TA, Johnson CL, Reed RB, Roche AF, Moore WM: Physical growth: National Center for Health Statistics percentiles. AM J CLIN NUTR 32:607-629, 1979. Data from the Fels Research Institute, Wright State University School of Medicine, Yellow Springs, Ohio.

BOYS: BIRTH TO 36 MONTHS
PHYSICAL GROWTH
NCHS PERCENTILES*



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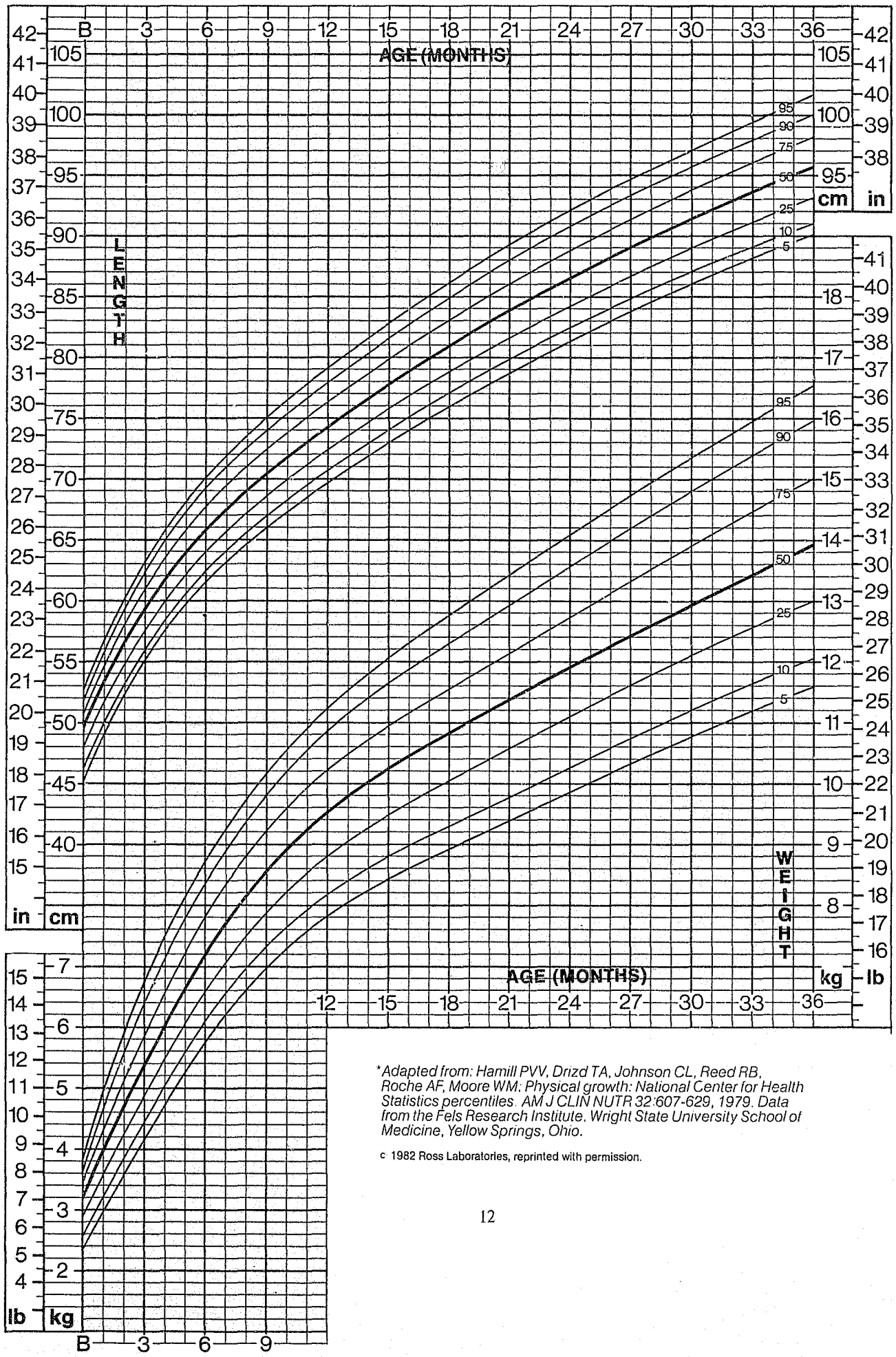
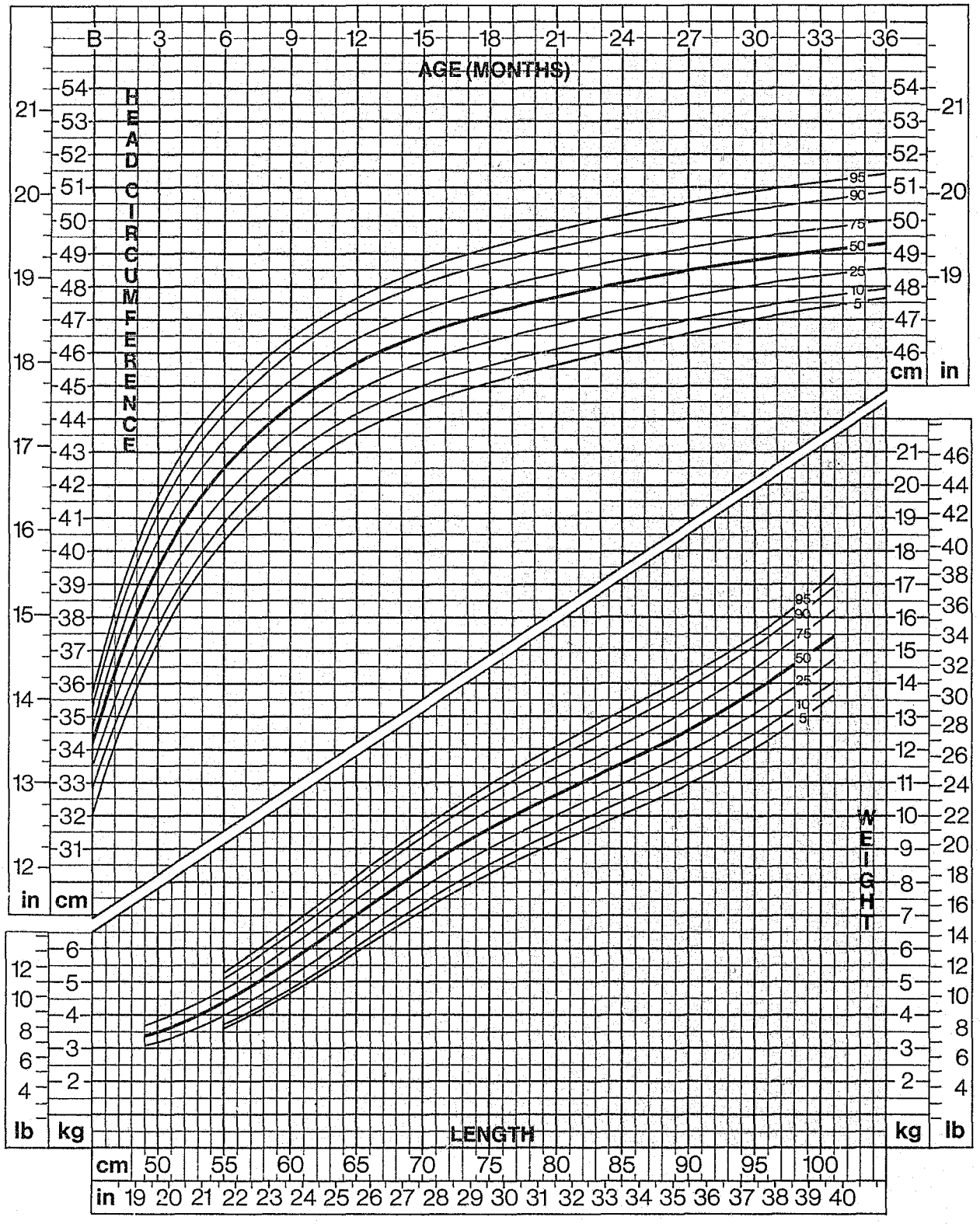
GIRLS: BIRTH TO 36 MONTHS
PHYSICAL GROWTH
NCHS PERCENTILES*



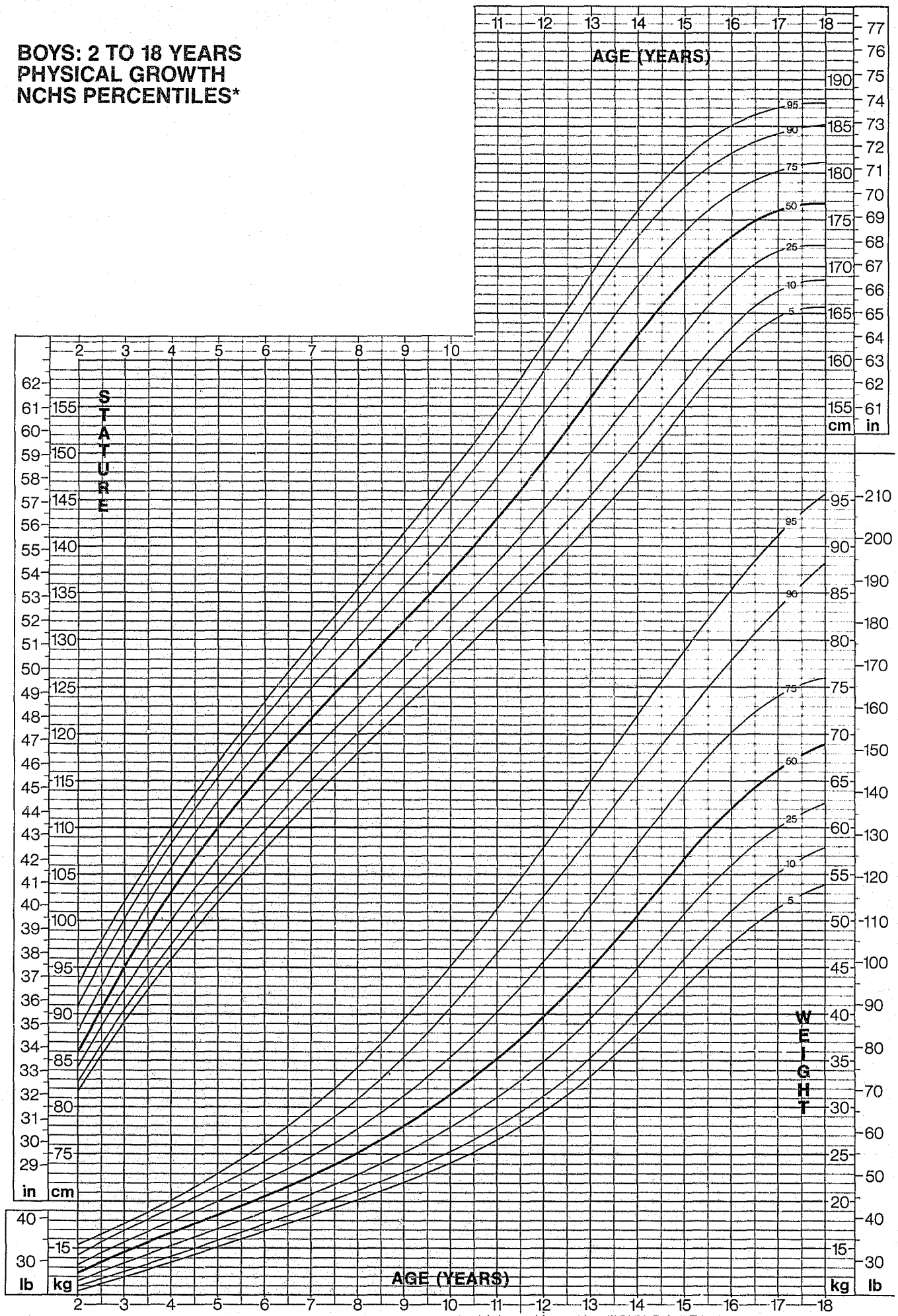
*Adapted from: Hamill PVV, Drizd TA, Johnson CL, Reed RB, Roche AF, Moore WM: Physical growth: National Center for Health Statistics percentiles. AM J CLIN NUTR 32:607-629, 1979. Data from the Fels Research Institute, Wright State University School of Medicine, Yellow Springs, Ohio.

GIRLS: BIRTH TO 36 MONTHS
PHYSICAL GROWTH
NCHS PERCENTILES*



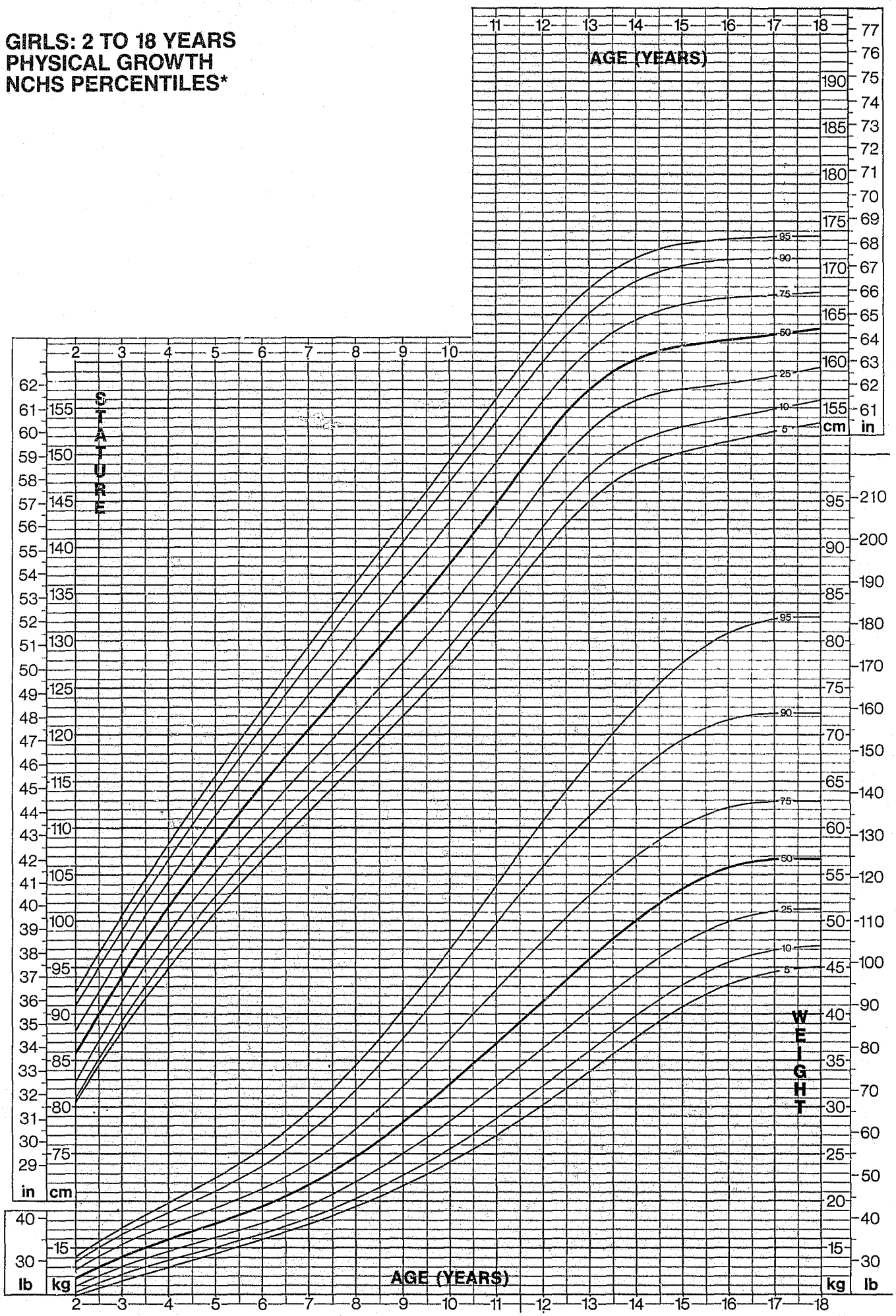
Adapted from: Hamill PVV, Drizd TA, Johnson CL, Reed RB, Roche AF, Moore WM: Physical growth: National Center for Health Statistics percentiles. AM J CLIN NUTR 32:607-629, 1979. Data from the Fels Research Institute, Wright State University School of Medicine, Yellow Springs, Ohio.

BOYS: 2 TO 18 YEARS
PHYSICAL GROWTH
NCHS PERCENTILES*



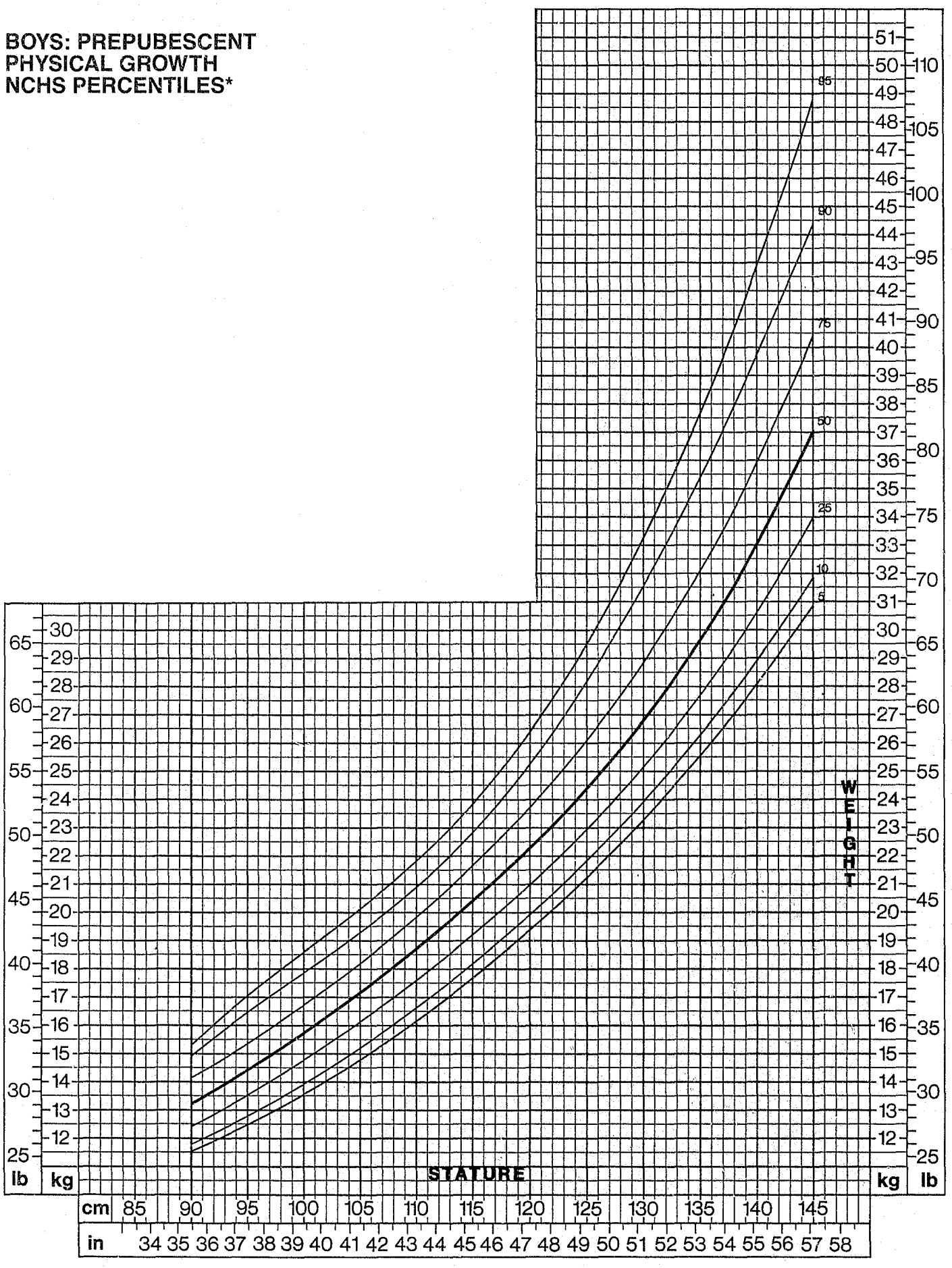
*Adapted from: Hamill PVV, Drizd TA, Johnson CL, Reed RB, Roche AF, Moore WM: Physical growth: National Center for Health Statistics percentiles. AM J CLIN NUTR 32:607-629, 1979. Data from the National Center for Health Statistics (NCHS), Hyattsville, Maryland.

GIRLS: 2 TO 18 YEARS
PHYSICAL GROWTH
NCHS PERCENTILES*



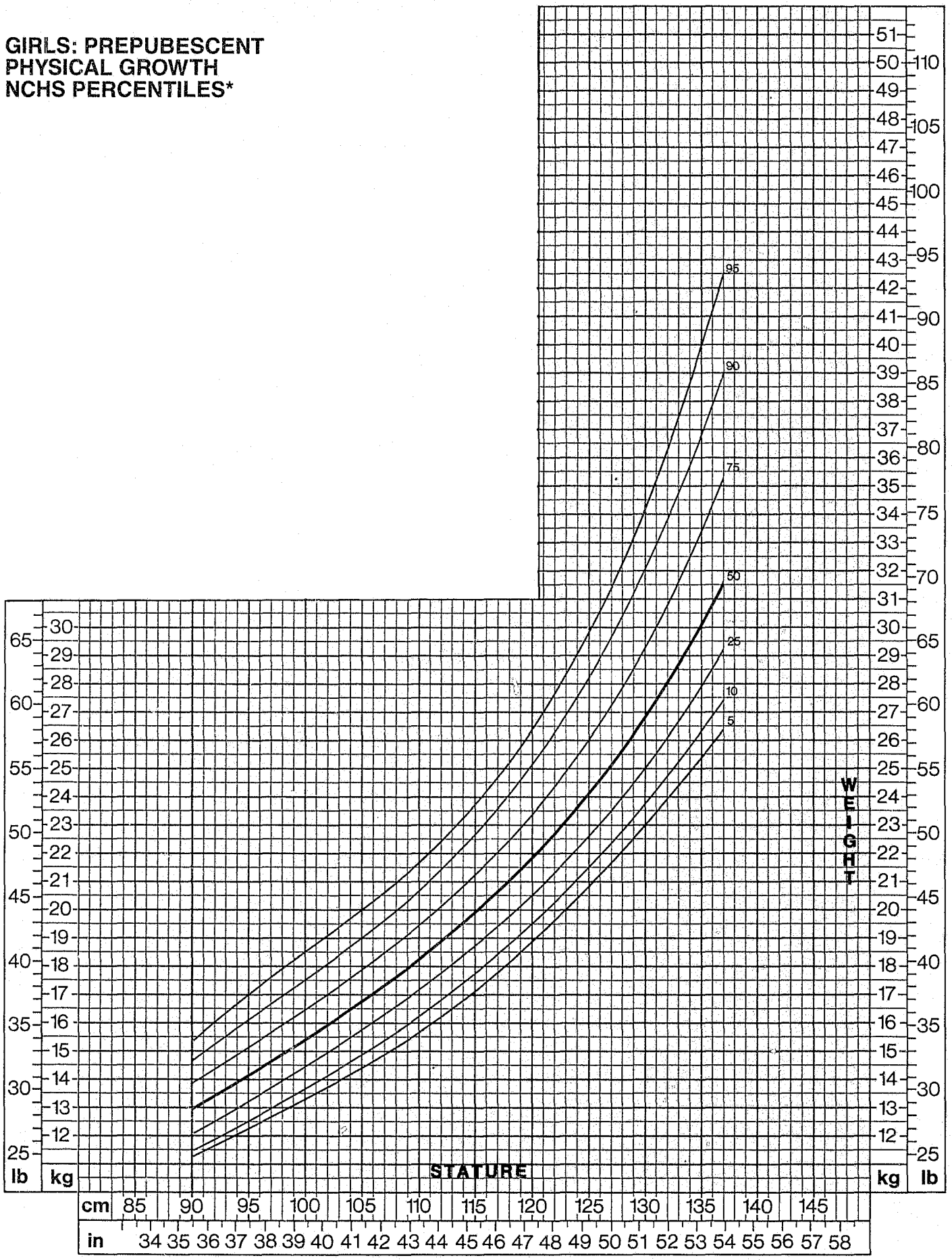
*Adapted from: Hamill PVV, Drizd TA, Johnson CL, Reed RB, Roche AF, Moore WM: Physical growth: National Center for Health Statistics percentiles. AM J CLIN NUTR 32:607-629, 1979. Data from the National Center for Health Statistics (NCHS), Hyattsville, Maryland.

BOYS: PREPUBESCENT PHYSICAL GROWTH NCHS PERCENTILES*



*Adapted from: Hamill PVV, Drizd TA, Johnson CL, Reed RB, Roche AF, Moore WM: Physical growth: National Center for Health Statistics percentiles. AM J CLIN NUTR 32:607-629, 1979. Data from the National Center for Health Statistics (NCHS), Hyattsville, Maryland.

GIRLS: PREPUBESCENT PHYSICAL GROWTH NCHS PERCENTILES*



Adapted from: Hamill PVV, Drizd TA, Johnson CL, Reed RB, Roche AF, Moore WM: Physical growth: National Center for Health Statistics percentiles. AM J CLIN NUTR 32:607-629, 1979. Data from the National Center for Health Statistics (NCHS), Hyattsville, Maryland.

APPENDIX E

NUTRITIONAL ASSESSMENT OF DECEASED CHILDREN

1. Calculate child's age to nearest ½ month under age 3, to nearest month age 3 and over. If child was premature, correct for gestational age up to age 5.

   Example: a. Birth date of March 25, 1980, 7 weeks premature;
   b. Death date is March 18, 1983;
   c. Calculated age is 3 years;
   d. Correcting for prematurity, age is 2 years, 10 months

2. Record weight to nearest ½ pound or 1 kg; correct for estimated degree of dehydration, if possible.
3. Record length to nearest ½ inch or 1 cm; correct for estimated shortening due to contractures.
4. Plot weight, height and weight for height on standard curves.
5. Interpretation:
   a. Weight for height
      1) ‹ 5th percentile indicates nutritional wasting:
      2) 5-10th percentile suggests nutritional wasting:
      3) › 95th percentile indicates obesity.
   b. Height
      1) ‹ 5th percentile strongly suggests nutritional stunting if weight for height ‹ 25th percentile;
      2) 5-10th percentile suggests nutritional stunting if weight for height is ‹ 25th percentile.
   c. Weight
      ‹ 5th percentile suggests nutritional wasting if weight for height is ‹ 10th percentile.

APPENDIX F

CHILD ABUSE BITE MARK GUIDELINES

IDENTIFICATION OF A BITE MARK

Teeth are essentially a tool. As such, because of their individual morphologic characteristics, and relationships with each other in the dental arch, they can leave a unique mark on the victim that sometimes can be traced to the perpetrator.

A bite mark will appear as a semicircular (one arch) or oval (both arches) mark on the body. Generally, no more than the anterior six or eight teeth in an arch will mark. Frequently, because of the interspersing of clothing, or nature of the bite, only a few of the teeth may make a mark. Because of the nature of a child's skin, bite marks can be very distinct. There may be additional bite marks on the body, of the same age, or in a partial state of healing, indicating repetitive attacks.

LOCATION OF BITE MARKS

Bite marks occurring in child abuse are usually found on the chest, abdomen, face or extremities.

RECOVERY OF EVIDENCE

Since many bite marks are present on victims who have sustained serious other trauma and are covered with dried blood and other debris, a careful examination of the body after removal of the clothing is necessary to preclude loss of serological evidence from the saliva of the perpetrator when the body is being medically treated or handled in the morgue.

CALL FORENSIC ODONTOLOGIST

Ideally, a trained forensic odontologist should be called to process the evidence PRIOR to any further disruption of the bite mark. In lieu of this, photographs of the injury should be taken with and without a mm scale in place. A suggested means is a Polaroid "SONAR ONE STEP" camera that focuses automatically, and allows the photographer to see the result immediately. After the evidence is photographed, saliva swabs should be taken from the injury. Moisten the swab in sterile saline and swab the area of the bite from the center outward. Allow the swab to air dry, and place it into an envelope. DO NOT LICK THE ENVELOPE TO SEAL IT! USE TAP WATER ON A GAUZE PAD. Take a second swab in the same fashion from the other side of the body as a control.

PHOTOGRAPHY

If a medical photographer is immediately available, the following should be done:

I. Photograph of the undisturbed injury
   A. Black and white high contrast

B. Color negative film (ASA 100)

- A KODAK color scale or a grey card along with a mm scale should be used in the frame of the photo
- All shots duplicated with and without scale/case ID in place
- Long orienting shot of the body
- Orienting shot of each bite mark
- Close up of each arch of bite with scale and circulate standard in place (a nickel or dime does nicely)
- Shot of entire bite in one frame with scales in place
- Scale used in photo MUST become part of patient file

II. Photographs of above after the injury has been cleaned.

IMPRESSIONS OF BITE MARK

Impressions of the bite should be made by an odontologist using accepted forensic techniques. Impressions of the victim's own teeth will also be taken as a matter of course to insure a legally complete procedure.

Police investigators should be advised that bite mark evidence is available, so that if a suspect is located, the State's Attorney may prepare a search warrant, court order, etc., to allow impressions to be made of the suspected abuser. Recognition and processing of such evidence may be a critical link to the perpetrator of the abuse.

APPENDIX G

INSTITUTIONAL RESOURCES

Resources

University of Chicago Hospitals and Clinics
Wyler Children's Hospital
Division of Biological Sciences
Pritzker School of Medicine
5841 S. Maryland Avenue
Chicago, IL 60637
312/702-6500

LaRabida Children's Hospital and Research Center
East 65th Street at Lake Michigan
Chicago, IL 60649
312/363-6700

University of Health Sciences
Chicago Medical School
3333 Green Bay Road
North Chicago, IL 60034
312/578-3000

University of Illinois
College of Medicine at Chicago
1853 West Polk Street
Chicago, IL 60612
312/996-3500

University of Illinois
College of Medicine at Peoria
P.O. Box 1649
Peoria, IL 61656
309/671-3000

University of Illinois
College of Medicine at Rockford
1601 Parkview Avenue
Rockford, IL 61107
815/987-7610

University of Illinois
College of Medicine at Urbana-Champaign
506 South Mathews
Urbana, IL 61801
217/333-9284

Resources

Loyola University of Chicago
Stritch School of Medicine
2160 S. First Avenue
Maywood, IL 60153
312/531-3000

Mount Sinai Hospital Medical Center
1500 South Fairfield
Chicago, IL 60611
312/542-2000

Northwestern University Medical School
303 East Chicago Avenue
Chicago, IL 60611
312/908-8649

Children's Memorial Hospital
2300 Children's Plaza
Chicago, IL 60614
312/880-4500

Rush Medical College of Rush University
600 South Paulina Street
Chicago, IL 60612
312/942-6913

Southern Illinois University
School of Medicine
801 North Rutledge
P.O. Box 3926
Springfield, IL 62708
217/782-3318

Cook County Hospital
1825 West Harrison Street
Chicago, IL 60612
312/663-6000

Cook County Children's Hospital
700 South Wood
Chicago, IL 60612
312/663-6530

Cook County Medical Examiner's Office
2121 West Harrison
Chicago, IL 60612
312/666-0500

American Academy of Forensic Sciences
225 South Academy Boulevard
Colorado Springs, CO 80910
303/596-6003

APPENDIX H

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