Pediatric Issues in Underwriting

Steven L. Cooper, MD

Mortality risk assessment of juvenile life insurance applicants with impairments can be challenging. Advances in neonatal care means more premature infants will survive into childhood and adulthood with attendant respiratory and neurologic disorders. The degree of neonatal lung disease and length of ventilator support are factors that help to separate out more favorable risks. Autism and other developmental disorders have diverse presentations, but in the absence of other neurologic conditions risks are generally limited to accidents. Children with attention deficit hyperactivity disorder without accompanying conduct disorder are less likely to have problems with drug abuse. Impaired pediatric lives mortality patterns depend on whether accidental death predominates.

Address: Lincoln National Life, 350 Church Street, Hartford, CT 06103; ph: 860-466-1059; e-mail: slcooper@lnc.com.

Correspondent: Steven L. Cooper, MD; 2nd VP and Medical Director.

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PREMATURE INFANTS

The definition of prematurity is birth prior to 37 weeks of gestation. Usually infants born prior to 37 weeks of gestation weigh less than 2500 g, or 5 lb 8 oz. These infants constitute approximately 10% of live births. The complications of prematurity occur with birth weights of less than 1500 grams and gestational ages of less than 32 weeks. For a juvenile born between 32 and 37 weeks of gestation, weighing 1500–2500 g, and with no complications, the mortality risk due solely to prematurity should be minimal. Infant mortality is increased at 37 weeks (5× normal) and is even greater at 32 weeks of gestation (45× normal).1

Respiratory disease is the most common cause of mortality in premature infants. Intracranial hemorrhage and necrotizing enterocolitis also contribute significantly to infant mortality, particularly in very low birth-weight premature infants. The risk of intracranial hemorrhage and necrotizing enterocolitis are much higher with lower birthweight and earlier gestational age. An important point from the insurance perspective is that survival of low birth-weight infants has increased markedly over the last 30 years. More applications from juveniles who have survived the neonatal period will be seen. As a result, medical directors need to be aware of possible sequelae in former low birth-weight preemies.

What has contributed to the increased survival of premature infants? Standardization and improvement in neonatal ICU care has been a major factor. Newer ventilation techniques and use of lung surfactant therapy have led to decreased neonatal mortality. In addition, the use of antenatal steroids to promote lung maturation has increased. However, increased morbidity, due to handicaps
and treatment complications, comes with increased survival. Neonatal ventilator use is associated with the risk of chronic lung disease or bronchopulmonary dysplasia.

**RISK FACTORS FOR ADVERSE OUTCOMES**

Although antenatal steroid use has led to a decrease in respiratory disease, postnatal steroid therapy for lung disease or for neurologic stabilization following intraventricular hemorrhage is an adverse risk factor. The requirement of continued hospital admission at term is also an adverse prognostic indicator. Both of these factors are associated with an abnormal neurologic outcome.

The lowest birth weight infants have the most significant morbidity and mortality, regardless of any other factors. Excluding the degree of ventilatory support, whether steroids were used, and whether infection or other complications occurred, mortality is 89% in infants that weigh 400–500 g, and 71% for infants that weigh between 500–600 g at birth. Infants born close to term, which required some ventilatory support and may have had complications, are also at risk for adverse outcomes that may be of concern when life insurance applications are submitted for juveniles at an older age.

Bronchopulmonary dysplasia (BPD), first described in 1967, is the classic premature lung disease. Interestingly, it was first described in term infants who had some respiratory problem that required ventilator use, not in preemies. In the original 1967 study, Northway et al. showed that BPD was more likely to develop if higher ventilator pressures were needed to oxygenate adequately, and if a higher fraction of inspired oxygen (FiO2) concentration was required. Today’s NICU survivors have chronic lung disease with a different physiology than the classic BPD described in somewhat more mature infants in 1967.

Rich et al looked at the factors that predict whether infants are going to need ventilator support. Over a 10-year period, they found that lower birthweight was associated with a higher likelihood of requiring ventilatory support. Chronic lung disease was best predicted by longer duration of ventilatory support, lower birth weight, and male gender.

Surfactant use has changed the lung findings seen in the chronic lung disease of premature infants. The original bronchopulmonary dysplasia was notable for airway injury, inflammation and fibrosis. The infant’s chest x-rays showed significant fibrotic changes. BPD seen in the modern era with surfactant therapy and improved neonatal care is not as likely to lead to fibrosis. Chest x-ray findings show less atelectasis and fibrosis than seen previously. An arrest in acinar development is now seen.

Up to 50% of infants with bronchopulmonary dysplasia require hospital readmission for lower respiratory disease in the first year of life. Hospital re-admission after term is an indicator of a bad prognosis. Therefore, it is important to look very carefully at the attending physicians statements (APS) of juvenile applicants who were premature to determine if they had to be readmitted to the hospital after their initial discharge. If so, it is important to determine if there is any suggestion that chronic lung disease or BPD have developed.

**PREDICTING RESPIRATORY PROBLEMS**

Oxygen, required at the time of initial hospital discharge, is a predictor of long-term respiratory problems. Most very low birth weight infants, who are followed until they are feeding and growing well, can be weaned from oxygen. If an infant continues to require oxygen at discharge, the likelihood of lung disease persisting into childhood and adulthood is greatly increased. The duration of oxygen requirement beyond 20 days of age has been found to be inversely related to FEV1 at 11 years of age.

Another problem associated with prolonged ventilator use is retinopathy of prematurity. This is a significant cause of childhood blindness, thought to be caused by high
FI0₂ concentration. Recently, it has been found that with good surveillance and early monitoring by a neonatal ophthalmologist, careful titration of inspired oxygen levels can prevent the retinopathy.⁵ Neonatologists titrate the inspired oxygen concentration to a level that is adequate to protect against lung disease but is not likely to cause eye disease.

The literature in regard to long-term pulmonary sequelae is relatively sparse. In a small study of 10 premature children, mean age of 10.4 years, all had respiratory distress syndrome after birth and developed BPD.⁶ These children were compared to a control group of full-term infants with no pulmonary problems of the same age. The children with BPD all had abnormalities of FEV₁ and FEF 25%–75% at age 10–11 years, indicating small airways disease. Their total lung capacity was also abnormal. Even though this study only included 10 children, it highlights the fact that prematurity, respiratory distress and ventilator usage have effects that persist late into childhood. The life insurance application of a juvenile survivor of prematurity, and lung disease of prematurity, must be carefully evaluated.

Hakulinen et al looked at respiratory morbidity in school-aged children who had been premature and required ventilator support.⁷ Respiratory morbidity and abnormal PFTs were more common in the infants who had BPD or chronic lung disease as opposed to being premature only but lacking BPD. This suggests a negative underwriting action to an application from a juvenile, who was born premature and may have been on a ventilator may not be warranted, as long as the juvenile has no other risks of lung disease, such as history of prolonged oxygen need, abnormal chest x-ray, and/or recurrent hospital admissions for infection after initial hospital discharge. Children who were born prematurely and required only short-term ventilator support tend to do well from a respiratory disease perspective.

Hack et al looked at the outcome of 242 very low birth weight infants (<1500 g) assessed at age 20.⁸ Few of these very low birth weight survivors had educational and social development similar to their peers. Fewer of these very low birth weight survivors graduated from high school, and they had a higher incidence of chronic medical conditions, such as seizure disorders, neurosensory problems, as well as short stature, growth and development issues. Interestingly, the very low birth weight group had less “risk-taking” behavior (such as drug use) than the control group. The authors speculated that the reason was increased parental supervision. These were children who were often described as the “vulnerable child,” and their parents kept a much closer eye on them compared to children in the control group. There was also less drug use, less sexually transmitted disease, and less risk taking behavior in the very low birth weight survivors, than their full-term counterparts.

**FAILURE TO THRIVE**

“Failure to thrive” is the term used to describe infants and children who fall below the 10th percentile on growth curves. It is a multifactorial process that involves social, nutritional and biologic factors. The degree of growth retardation and the duration of follow-up have not really been shown to have an effect on outcome. Some children who are just slightly below the 10th percentile do poorly, and others who are far below the 10th percentile do quite well. Factors such as birth weight, the age a child began to fall behind the growth curve, social factors, and parental parameters may have more of an effect on the ultimate outcome than the degree of growth retardation. Certain paternal parameters and the mother’s height also have some impact on the child’s outcome.

Failure-to-thrive children tend to have problems with cognitive issues. A large meta-analysis published in 2004 indicated that failure to thrive in infancy is associated with adverse intellectual outcomes sufficiently large to be of importance at a population level.⁹ This analysis concluded that children who fall below the 10th percentile in growth likely
go on to have problems in adulthood; social problems, difficulty holding a job, interpersonal relationship problems, conduct disorders, etc. Failure to thrive in infancy is not something that is included in life insurance application questionnaires. However, when a juvenile applicant is evaluated, it is important to look for and assess growth charts in an APS from the pediatrician. If a normal 50th percentile growth pattern is seen, failure to thrive is not a consideration. On the other hand, if height, weight, and head circumference consistently fall below the 10th percentile, failure to thrive may be a concern.

**DEVELOPMENTAL DELAY**

Developmental delay encompasses conditions such as cerebral palsy (CP), autism, chromosomal disorders, and muscular dystrophy. The outcome depends on the specific diagnosis and the presence of comorbidity. Failure to thrive, by itself, is a contributor to poor outcome. These children may have seizures, and may have had a tracheostomy because of long-term ventilator need, or a gastrostomy because of feeding problems. Risk of leukemia and cardiac abnormalities is increased in Down syndrome and other chromosomal disorders. Applications for children with developmental delay and significant comorbidity, generally have mortality risks that are easy to identify.

Developmental delay without significant comorbidity is more difficult to evaluate. Pervasive Developmental Delay encompasses the following diagnoses: autism, Asperger's syndrome, Rett's syndrome, childhood disintegrative disorder, and pervasive developmental delay-nonspecific.

Autism is defined as extreme difficulty in social interaction and communication. Usually, autism is obvious before age 3. This important fact should be kept in mind during the evaluation of a school-age, or teen-age applicant in whom concern of autism was raised. Autism usually does not begin at ages above 3. Though possible, one should be somewhat suspicious about autism as first entertained at age 8 or 10. Of course, there is a tremendous range in symptom expression, and there is no specific laboratory test. However, history and clinical presentation may suggest the need for additional testing to rule out other disorders.

Asperger's syndrome includes symptoms of difficulty in social interaction, with no difficulty in language skills. These children generally have average or above average intellectual testing for their age and are often referred to as highly functioning autistics. Asperger's syndrome has become a more frequent diagnosis.

Rett's syndrome is rare and occurs only in girls. Following initial normal development, there is a sudden loss of skills and loss in control of the hands, characterized by hand wringing or shaking that is very striking. It develops "out of the blue" in children between the ages of 1–4 who have been developing normally and had no history of abnormal birth trauma or similar events.

In childhood disintegrative disorder (CDD), affected children develop normally until age 2 and then lose social skills with a tendency towards autistic behavior. This condition is on the continuum of autism, differing in the manner and age of presentation and the timing of skills loss.

Pervasive developmental delay-nonspecific is diagnosed when the symptoms of other disorders are not present, and when there is considerable difficulty with specific behaviors. Because other disorders can masquerade as autism, developmental disorders of language can be very difficult to separate from autism early in their course. Developmental disorders of language are very specialized disorders and require careful pediatric neurobehavioral evaluation to distinguish it from autism. Early onset schizophrenia may also present in a manner that resembles autism, but has very different implications and treatment. The DSM-IV has specific criteria for the diagnosis of autism, and in most cases, the diagnosis is apparent in the preschool years. Autistic symptoms are usually apparent to
the parents, but if not, symptoms are obvious to a teacher when the child starts school.

**MORTALITY AND AUTISM**

The Life Expectancy Project in San Francisco studied 13,111 subjects with autism between the years of 1983 and 1997.\(^\text{10}\) This study found that there was an increased mortality rate for several causes, including seizures and accidents. Excess mortality was especially marked if autism was accompanied by severe mental retardation. Life expectancy was reduced even if the autistic individual was fully ambulatory and only had mild mental retardation. In general, if an autistic individual does not have seizures or severe mental retardation, most mortality risk can be attributed to accidental death.

The Shevelle et al study in *JIM* in 1998 found that life expectancy in autism was reduced by 6.1 and 12.3 years at age 5, for males and females, respectively, which is based on the California Department of Developmental Services database.\(^\text{11}\) By age 60, the effect of autism diminishes. The mortality risk of autism at age 5 is much higher than the mortality risk of autism in adults who survive to their 50s and 60s. The key point for mortality risk assessment is that one should worry far more about a 5-year-old applicant than a 55-year-old with autism.

**ADHD**

Attention deficit hyperactivity disorder (ADHD) is defined by DSM-IV criteria. It is important to exclude pervasive developmental delay, psychosis, mood disorder, anxiety, personality disorder, dissociative disorder as the basis of presenting symptoms. ADHD is a stand-alone diagnosis, and its symptoms begin prior to age 7. When considering the diagnosis of adult ADHD, an individual has to have had childhood ADHD to truly be considered to have adult ADHD. The clinical presentation of these children is as expected. These children are hyperactive, very fidgety, squirming, have difficulty focussing on a task, and are inattentive to boring mental activity. They are slow to wake, fall asleep without difficulty, and have outbursts of explosive behavior that go along with this ADHD presentation. Jack Cotlar's 2003 *JIM* article about adult ADHD made the point that ADHD is the most common neurobehavioral disorder in youth with a prevalence of 4%–5%.\(^\text{12}\) ADHD is often associated with anxiety, mood disorders, disruptive disorder and substance abuse, and persists into adulthood in about 60% of cases. The association with anxiety, mood disorders, disruptive disorder, and substance abuse receives the most attention, because these are associated with mortality risk.

What is the course of ADHD? In early to middle adolescent ADHD patients, two thirds to three fourths have some problem with academic and social functioning, a sizable proportion. Forty percent continue to have these problems into their late teen years.\(^\text{13}\) The greatest risk for development of antisocial behavior and substance abuse is for individuals with ADHD symptoms that continue into the late teenage years. Almost half of children with ADHD do maintain symptoms into their late teenage years. These issues may be difficult to identify during the evaluation of an insurance application. There may be occasions where school records or other documentation will provide more detail concerning academic and social function, which may allow an offer of insurance.

ADHD differs with gender. Girls with ADHD have lower levels of hyperactivity than boys. Boys more often have a comorbid conduct problem, and tend to act out more with their ADHD. Boys are disruptive in school and cause problems for teachers that tend to be very noticeable. Interestingly, girls with ADHD and a conduct disorder have more social problems than boys do. Girls who have ADHD and a conduct disorder run into more social problems. Girls may have a poorer adult psychiatric outcome than boys according to one study,\(^\text{14}\) but other studies that confirm this were not found.

ADHD and substance abuse is a definite
problem. Substance abuse is increased when ADHD coexists with a conduct disorder. Of children with ADHD, 20%–50% are likely to have a conduct disorder, and 25% will have an antisocial personality disorder, a known risk factor for substance abuse and dependence. Substance abuse is not an inconsequential problem for a child and particularly an adolescent with ADHD and a conduct disorder.

There is a 3- to 4-fold increase in driving-related accidents and associated injuries in ADHD. As expected, increased accidents appear to be due to inattentive vs impulsive driving errors. The controlled release form of Ritalin improves real-life driving performance of adolescent males with ADHD. Because the traffic accident potential is diminished by controlled release Ritalin, this treatment may be considered a favorable factor, during the assessment of an applicant with ADHD. Similar studies have not yet been conducted to evaluate newer generation ADHD medications like Strattera.

To emphasize, adult ADHD is a difficult diagnosis to make without a history of some symptoms prior to age 7. The symptoms of adult ADHD overlap with depression and substance abuse, the diagnostic criteria include symptoms of inattention, or hyperactivity and impulsivity. It does not arise de novo in adults. These are individuals who had ADHD that manifested prior to age 7, with continued ADHD symptoms into the adult years.

**PEDIATRIC RISKS—MORTALITY PATTERNS**

General guidance concerning the mortality of pediatric impairments can be summarized as follows. For those impairments associated with a high accident potential, such as ADHD, autism, and other developmental delays, there is a role for permanent flat extras to match mortality patterns in these impairments. A fairly constant excess death risk, primarily due to accidents is present. On the other hand, for a premature infant who has survived into childhood with a respiratory impairment, table ratings may be more appropriate for the mortality associated with these risks. Likewise, children with asthma or seizure disorders are most appropriately covered with a table rating, similar to the method the mortality risk of these impairments are assessed in adults. That is, a proportional increase in mortality risk that increases with age, most closely fits the mortality patterns that may be seen.

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**REFERENCES**


