Chapter 12
Adolescents and Asthma

David R. Naimi and Andrea J. Apter

Introduction

Adolescence is a time of rapid development where children undergo marked physical, intellectual, and psychosocial growth. This transitional period between childhood and adulthood usually encompasses the second decade of life, although its onset and duration can vary. In children with chronic illness including asthma, adolescence is an important period for establishing proper self-management and coping skills. In fact, asthma is the most common chronic illness of adolescence (Mannino et al. 1998; 2002). The capacity to manage one's disease is an essential component of asthma care and is influenced by adolescents' increasing maturity; growing need for independence and engagement in health risk behaviors. Consequently, effective communication between the adolescent patient, their family, school and health care provider is essential to achieve optimal control. This chapter will review these influences on asthma self-management and discuss their implications for effective patient-provider communication.

Epidemiology of Adolescent Asthma

Over the last two decades, the prevalence of asthma among children of all ages has been on the rise, although new data suggests that it may have reached a plateau in recent years (Akinbami and Schoendorf 2002). Determining asthma prevalence in adolescents requires some estimation, since data is reported using different age ranges. For example, according to the 2005 Youth Risk Behavior Surveillance System (YRBSS), 17% of students had ever been told by a doctor or nurse that they had asthma. The survey found the prevalence of lifetime asthma higher in 11th grade males compared with females (18.2% vs. 14.6%), although in 9th graders the prevalence in females was higher (18.7% vs. 14.6%) (Eaton et al. 2006). Thus, approximately 15% of adolescents have been told at some point in their lives that they have asthma.

According to the latest CDC survey (2002b) of 10–17 year olds, asthma prevalence differs by demographic group and socioeconomic status. American Indians/Alaska Natives have the highest prevalence of lifetime asthma diagnoses (21%), followed by non-Hispanic blacks (18%), non-Hispanic whites (15%), Hispanics (13%), and Asians (7%) (CDC/NCHS 2002a). However, it should be noted that among all ethnicities, Puerto Ricans have the highest prevalence of lifetime asthma (27%) (CDC/NCHS 2002a). The relatively lower total percentage of affected Hispanics is attributed to the Mexican population who demonstrated a lifetime asthma diagnoses of 11% (CDC/NCHS 2002a). Morbidity and mortality rates associated with asthma are significantly higher among racial and ethnic minority groups than nonminority groups (Schwartz et al. 1990). In 2002, the mortality rate for non-Hispanic black children was more than twice than the non-Hispanic whites (CDC/NCHS 2002b). Puerto Ricans have greater asthma mortality rates than non-Hispanic whites, but there is less data for the adolescent age group, for other Latino groups, and other minority groups. Children from low-income families (14%) are more likely to have ever been diagnosed

D.R. Naimi (✉)
Clinical Assistant Professor of Pediatrics, University of Washington, Northwest Asthma & Allergy Center, Suite 200, Springbrook Professional Center, 4540 Sand Point Way NE, Seattle, WA, 98105-3941, USA
e-mail: dnaimi@nwasthma.com

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with asthma and to have more severe asthma than children from more affluent families (12%) (Bloom and Dey 2006; Chen et al. 2003b).

Adolescence is the time of cognitive growth and psychosocial development, which includes formation of identity. This age is also characterized by risky behaviors that threaten health including unprotected sexual activity, cigarette smoking, substance abuse, and poor nutrition all of which can affect adherence and potentially complicate the management of asthma (Bender 2006; Hovell et al. 2003). According to the 2005 YRBSS, 37% of sexually active high school students did not use condoms, 23% had smoked cigarettes in the 30 days before the survey, 43% had drunk alcohol, and 2% had injected an illegal drug (Eaton et al. 2006). Additionally, 80% had not eaten the recommended fruits and vegetables during the 7 days preceding the survey. Along with their nonasthmatic peers, adolescents with asthma have been shown to participate in risk behaviors such as smoking and substance abuse (Bender 2006; Forero et al. 1996; Zbikowski et al. 2002).

Of potential comorbidities in asthmatic adolescents, obesity and depression may be the most significant. Depression affects up to 17% of adolescents (Hankin 2006), and 8.4% of adolescents have attempted suicide (Eaton et al. 2006). In adolescents with asthma, depression may increase the likelihood of risk behaviors such as smoking, which may in turn contribute to poor asthma control (Bender 2006). Additionally, more than 30% of children between 6 and 19 years are overweight or above the 85th percentile for weight (Hedley et al. 2004).

Low-income and minority adolescents are at increased risk for asthma, obesity, and symptoms of depression (Miech et al. 2006; Rushton et al. 2002). Thus, adolescents from low income minority groups are at risk for several comorbidities that can threaten their health.

Asthma as a Chronic Disease

Adolescents with a chronic disease appear to have more difficulty with psychological adjustment, more behavioral disorders, and lower self-esteem (Suris et al. 2004). In general, the impact of a chronic disease on psychosocial development, feelings of well-being, and perception by others is related to the severity of the disease and the intrusiveness of the required treatment (Suris et al. 2004). One survey of elementary school teachers found that asthma is perceived by asthmatic adolescents, their peers, and teachers to have less impact on their lives than other chronic diseases like cystic fibrosis or epilepsy (Olson et al. 2004), although the physical impact of significant asthma was perceived equivalently with diabetes in another study (Wirrell et al. 2006). In that study, teens without asthma regarded asthma as primarily affecting exercise ability of asthmatic peers. Exercise ability may be particularly important to the adolescent age group, but only 4% of surveyed "normal" teens reported any reluctance to befriend a peer with asthma (Wirrell et al. 2006). This suggests that mild asthma is likely to have little psychosocial impact. Nevertheless, feelings of loneliness, unhappiness, depression, and somatic complaints were more frequent in asthmatic adolescents than healthy controls in some but not in all studies (Forero et al. 1996). As in other chronic diseases, the impact of asthma may be more significant with severe disease.

Effect of Asthma on Growth and Puberty

Delayed growth and puberty is common in severe chronic illnesses, particularly in those characterized by chronic inflammation and malnutrition such as cystic fibrosis and inflammatory bowel disease. While permanent growth loss may occur (Kelly et al. 2003), chronic illnesses that are less severe may cause a transient growth delay, ultimately resulting in normal adult height after catch-up growth.

With regards to asthma, the Childhood Asthma Management Program (CAMP) examined whether mild to moderate persistent asthma sufficient to produce a decrease in baseline lung function, is associated with an adverse effect on growth and bone mineral density (BMD) in children. This secondary analysis (the primary analysis was a randomized controlled trial comparing chronic nedocromil with inhaled budesonide) was a cross-sectional study of 1,041 children (32% ethnic/racial minorities and 40% female). The investigators found that in children aged 5–12 years with mild-moderate asthma of as long as 4–7 years' duration did not demonstrate an adverse effect on linear growth or BMD (Kelly et al. 2003). However, a small, transient reduction in growth velocity was

observed (The CAMP Research Group 2000). The past use of corticosteroids did not adversely affect either growth or BMD. Other analyses of CAMP data demonstrated no effects of chronic inhaled steroid (budesonide) treatment on the hypothalamic-pituitary-adrenal axis function over a 3-year period (Bacharier et al. 2004). Certainly, in moderate to severe asthma that may require higher doses of inhaled corticosteroids as well as frequent courses of oral steroids, the impact on growth and development may be significant.

Adolescents with delayed puberty, as may occur in severe asthma, may be treated differently by adults and peers, resulting in difficulties in school and work due to their apparent immaturity (Power and Manor 1995). The potential impact of delayed puberty caused by chronic illnesses can affect a child's psychosocial development, altering self-image, and causing emotional immaturity and a subsequent difficulty in separating from parents (Suris et al. 2004).

Barriers to Asthma Control

There are many barriers to asthma control, but some are unique to the adolescent age group and will be reviewed in the following sections. These include cognitive, identity, risk taking, body image, mood, peer and family relationships, socioeconomic, racial/ethnic, and community factors. While exposures to infectious agents and seasonal and perennial allergens are important causes of asthma exacerbations, they are not unique to this age group and are covered thoroughly in other texts (Adkinson et al. 2003). Since self-management skills tend to be deficient in teens (Bruzzese et al. 2004), this manuscript will focus on psychosocial influences of particular importance for asthma self-management that are unique to adolescents (Bruzzese et al. 2004). These barriers can be considered arising from a variety of levels: individual, family and peer interactions, and neighborhood and larger community influences.

Individual Influences

Chronic illnesses including moderate or severe asthma require constant medical management but are also typically characterized by a variable course marked by periods of acute crisis (LeBlanc et al. 2003). There are also asymptomatic periods, occurring more frequently in milder asthma, when medications must be continued. Thus, asthma may require an individual of any age to adjust to frequent medical visits, physical changes, daily medical regimens, and to prepare for recurring acute medical emergencies (Eiser 1990). For adolescents, these accommodations must be achieved in a context of growing independence, increasing ability to understand concepts related to health, and the new assumption of responsibility for self-management. Accommodations for asthma self-management also must occur in the setting of some important health-beliefs unique to this age group surrounding invincibility and pre-occupation with body image (Radzik et al. 2002). Co-morbidities are relatively infrequent in this age group. Nevertheless, in adolescents with asthma, mood fluctuations, behavioral disorders, depression, and obesity are among the most common that are likely to influence asthma outcome.

Adolescent Thinking

Unlike younger children, adolescents can integrate and consider several concepts at once, think abstractly and logically, and solve problems (Radzik et al. 2002). They can understand different perspectives and have an increased capacity to acquire new knowledge (Bruzzese et al. 2004). Adolescents are also able to describe and evaluate their own thinking (Bruzzese et al. 2004). These evolving cognitive skills provide the potential for successful management.

Adolescent Identity

Development of an identity is a key task of adolescence (Radzik et al. 2002). Identity comprises an individual's perceived defining features, values, beliefs, strengths, and weaknesses; is influenced by parents and increasingly by peers; involves formation of self-image and ego and includes significant attention to body image as part of one's identity. Adolescent identity also tends to include beliefs surrounding invulnerability. These perceptions of invulnerability and body image are particularly relevant to the overall health of the adolescent with asthma.

Invulnerability and Risk-Taking Behavior

Perceptions of invulnerability, orientation to the present (Sawyer and Aroni 2005), and lack of impulse control (Radzik et al. 2002) may underlie adolescents' tendency to engage in risky behavior more commonly than adults. Risky behaviors, a leading cause of morbidity and mortality among youth and adults, include unprotected sexual activity, cigarette smoking, abuse of alcohol and other substances, unsafe driving practices, and even poor diet (Eaton et al. 2006; Neinstein et al. 2002). Although preventable, these patterns of risk-behaviors are often established during childhood and peak in mid-adolescence, but may extend into adulthood (Eaton et al. 2006). Reckless behavior has been understood to be a function of the egocentrism of adolescence (Harris et al. 2002), peer-pressure, and other aspects of social environment. Harris et al. (2002) have suggested that a "nothing to lose" attitude is associated with risky behavior. In particular, adolescents with low expectations about their future may have little regard to the consequences of such behavior. It is hypothesized that individuals who do not experience academic success may be at increased risk of engaging in such thinking, while those who go on to college have better expectations of the future and are perhaps, less likely to engage in risky behavior (Harris et al. 2002).

Along with their healthy peers, adolescents with asthma have been shown to participate in risk-taking behaviors such as smoking and substance abuse (Bender 2006; Zbikowski et al. 2002). In fact, smoking rates in adolescents with asthma have been shown to be higher than their healthy peers (Forero et al. 1996; Tyc and Throckmorton-Belzer 2006; Zbikowski et al. 2002). In one community-based study of 4,550 11–17 year olds from Australia, tobacco use and alcohol consumption were higher in asthmatic adolescents (Forero et al. 1996). In another study of asthmatics aged 18–29 years presenting to an emergency department with acute asthma, approximately 33% smoked daily (Silverman et al. 2003). This information is undoubtedly concerning since asthma is particularly recalcitrant to treatment in current smokers (Tomlinson et al. 2005; Tyc and Throckmorton-Belzer 2006).

Risk-taking behaviors may be associated with poor treatment adherence and depression (Bender 2006; Hovell et al. 2003; Kilpatrick et al. 2003). This latter association is important since depression, like risk-taking behavior, is also associated with poor adherence and together may further increase the risk of poor asthma outcome (Bender 2006; DiMatteo et al. 2000). In fact, deaths from asthma are often associated with nonadherence to medications, psychological dysfunction (Jorgensen et al. 2003; Sturdy et al. 2002), denial of symptoms, and poor asthma management (Kravis 1987; Strunk 1987).

Body Image

Body dissatisfaction and distortion of body image peak during adolescence, particularly in females (Bruzzese et al. 2004; Littleton and Ollendick 2003; Radzik et al. 2002). Adolescents with chronic illness report higher dissatisfaction with body image (Suris and Parera 2005). Also, dissatisfaction with body image is common in obese adolescents (Wardle and Cook 2005). This dissatisfaction may result in unhealthy eating behaviors to preserve thinness (Radzik et al. 2002; Suris and Parera 2005). In fact, 12.5% of high school students in the United States had a recent history of going without eating for more than 24 h to lose weight or to keep from gaining weight (Eaton et al. 2006). Body image problems have been observed to lead to an increase in sexual behavior and unsafe practices, which may be increased in adolescents with chronic disease (Suris et al. 2004).

For adolescents with asthma, concern about body image may influence self-care and asthma control. Fear of changes in appearance related to systemic steroids and the perception of change due to inhaled steroids may influence adherence to asthma medications. Concern about appearance may be related to emphasis on athletic achievement (McCreary and Sasses 2000), which may be impaired by significant asthma. Finally, body dissatisfaction has been found to be associated with low self-esteem and negative emotions (Littleton and Ollendick 2003) including depression (Poli et al. 2003; Kelsay et al. 2005), which can also influence asthma outcomes as discussed below.

Behavioral and Mood Disturbances

Behavioral disturbances and depression are common in adolescents. As many as between 20% and 50% of teens report some level of depressive symptoms (Hankin 2006; Sarles and Neinstein 2002). In fact,

these conditions are reported to be more common in those with chronic illnesses (LeBlanc et al. 2003). Disease severity and the complexity of its treatment may increase the likelihood of behavioral disturbance (Engström 1999).

Nevertheless, it is well to remember that this finding is not universal (Kean et al. 2006). Studies examining psychological difficulties in children and adolescents with chronic disease including asthma have produced contrasting results, with some finding such a link (Creer et al. 1983; Forero et al. 1996; Forrest et al. 1997; Hambley et al. 1989) and others finding no increase in psychological problems (Bender et al. 2000a, b; Suris et al. 1996; Wamboldt et al. 1998). For example, Wamboldt et al. (1998), in a study of 337 children aged 7–19 years, demonstrated that children and adolescents with severe asthma did not rate themselves as having higher levels of anxiety than those with mild or moderate asthma or healthy controls. However, in a cross-sectional survey conducted on a school sample of more than 3,000 U.S. teenagers, Forrest et al. (1997) found that those with asthma and recent wheezing had more physical and emotional symptoms, poorer functional status, lower perceived well-being, more negative behaviors that threatened to disrupt social development, and a greater number of co-morbidities.

The conflicting findings in these studies may in part be explained by the differences in the subject populations. The studies that found relatively little psychological difficulty among adolescents and children with asthma largely consisted of subjects from outpatient clinical sites (Bender et al. 2000a, b) who likely have milder asthma than those requiring prolonged hospitalizations for asthma (Creer et al. 1983; Hambley et al. 1989). The data from all of these studies suggests that in asthma, as in other chronic illnesses, severity of disease is associated with a greater adverse impact on psychological functioning.

Several studies suggest that adolescents with asthma can be more vulnerable to panic symptoms (Perna et al. 1997; Rietveld et al. 2005; Goodwin et al. 2004; Gillaspy et al. 2002). Also, both adolescents with asthma and parents of adolescents who have experienced a life-threatening asthma exacerbation may have high levels of posttraumatic stress symptoms, which can accompany functional impairment due to asthma (Kean et al. 2006). Thus, asthma symptoms can be frightening to patients and their caretakers, resulting in symptoms that can mimic asthma accompanied by symptoms that are manifestations of poor asthma control.

Depression often begins in adolescence (Hankin 2006) and may occur with other disorders, particularly anxiety and disruptive behavioral disorders (Hankin 2006). Depression and anxiety, common in patients with asthma, can be associated with an increase in risky behaviors such as smoking and substance abuse and negatively correlated with treatment adherence (Bender 2006; DiMatteo et al. 2000; Kilpatrick et al. 2003). According to a 21-year longitudinal study in adolescents and young adults, asthma was associated with an increased likelihood of major depression, panic attacks, and any anxiety disorders when compared with individuals without asthma (Goodwin et al. 2004).

The mechanistic link behind the statistical association of asthma with depressive and anxiety disorders is complex and unclear. These associations could reflect the fact that asthma may provoke depression or anxiety disorders, or that depression and anxiety disorders may provoke asthma (Goodwin et al. 2004). In addition, other confounding factors such as genetic vulnerability (Wright et al. 2005) or distressed caretaker–child relationships and other negative events may account for some of the comorbidity of asthma and depressive/anxiety disorders, rather than a direct causal link (Goodwin et al. 2004).

Obesity

Besides depression, the comorbidity most likely to impact adolescent asthma is obesity (Hedley et al. 2004). As the overall prevalence of asthma in children and adolescents has increased over the last two decades (Mannino et al. 2002), so has the prevalence of obesity in this age group (Hedley et al. 2004). Among adolescents (12–19 years) and younger children (6–11 years) 16% are overweight according to the 1999–2002 data from the National Center for Health Statistics (Hedley et al. 2004). These numbers are triple the rate of obesity for adolescents in 1980 (Hedley et al. 2004). An additional 15% was considered at risk of becoming overweight defined as between the 85th and 95th percentile of sex-specific Body Mass Index (BMI) (Hedley et al. 2004). Overweight adolescents are at increased risk of developing diabetes as an adolescent. They are also at risk for becoming overweight as an adult, and acquiring the obesity-related health problems of adults

including diabetes and cardiovascular disease (Hedley et al. 2004). Additionally, in adolescents, obesity is a risk factor for depression and depression is a risk factor for obesity (McElroy et al. 2004); and as a result, the combination adds to a risk of poor asthma control.

The increased prevalence of obesity among children in the United States is highest among Mexican–American (23%) and non-Hispanic black adolescents (21%) when compared to non-Hispanic white adolescents (14%) (Hedley et al. 2004). Thus, the groups at increased risk for asthma and obesity overlap. The recent dramatic increase in both high BMI and asthma has led to the hypothesis that increased weight causes asthma (Flaherman and Rutherford 2006).

Although a number of studies have shown a statistical association between asthma and obesity in children, adolescents, and adults, the finding is not universal (Beuther et al. 2006; Chinn 2003; Ford et al. 2004). Some studies have been limited by self-report data of BMI or asthma (Gilliland et al. 2003; Gold et al. 2003; Flaherman and Rutherford 2006; Guerra et al. 2004). Some of these studies had cross-sectional designs (Figueroa-Muñoz et al. 2001) that do not allow conclusions about whether asthma predicts obesity, and obesity is associated with future asthma, or if a causal relationship is lacking. A randomized trial would provide excellent support for a causal relationship but such studies are rarely feasible or practical.

Several longitudinal studies have examined the relationship between asthma and obesity in children and adolescents. Gold et al. (2003) in a large study of 6–14 year olds followed for 5 years, found an increased risk of asthma (parent report of doctor-diagnosed asthma with persistent wheeze) in obese children. Gilliland et al. (2003) in a large study of 7–18 year olds followed for 4 years also found the risk of developing asthma was higher in those who were obese. In a population-based cohort study, Guerra et al. (2004) found that being overweight at age 11 was associated with a threefold increased risk for persistence of infrequent wheezing after the onset of puberty and with a twofold increased risk for persistent asthma. Finally, in a recent meta-analysis of the effect of high weight on asthma, high body weight among school-aged children increased the risk of future asthma by approximately 50% (Flaherman and Rutherford 2006). Although these studies were longitudinal, they were also observational and used self-report of a doctor's diagnosis of asthma without more stringent diagnostic criteria such as spirometry.

The biological basis for a causal relationship between asthma and obesity is not clear but several possibilities have been suggested. Some have postulated that dietary components associated with hypercholesterolemia (Al-Shawwa et al. 2006) or increased intake of polyunsaturated fats might provide links between obesity and asthma (Flaherman and Rutherford 2006). A more detailed theory is that leptin, increased in obese humans, is a promoter of inflammation in which its structure is similar to interleukin-6 (IL-6), a promoter of T-cell proliferation and activation (Beuther et al. 2006). Other possible links of asthma and obesity may be the presence of gastroesophageal reflux (which is prevalent in both conditions), hormonal influences, atopy, chronic systemic inflammation, and the mechanical effects of obesity (Beuther et al. 2006; Flaherman and Rutherford 2006; Shore and Fredberg 2005). Finally, excess weight may cause shortness of breath and exercise intolerance that may be mistaken for asthma.

To support the hypothesis that weight plays a role in the persistence of asthma symptoms, studies are needed to demonstrate that weight reduction among individuals with well-characterized asthma results in improvements in lung function and decreased symptoms (Guerra et al. 2004). However, to date, there are relatively few published reports of such research. One trial of 14 adults, randomized subjects to a very restrictive diet for a short duration of time (Hakala et al. 2000; Stenius-Aarniala et al. 2000). Other studies have examined the effects of bariatric surgery in adults. While improvement in respiratory comorbidities have been described (Spivak et al. 2005), many of the studies of bariatric surgery patients have been observational without strict criteria for asthma (Ahroni et al. 2005; Spivak et al. 2005). In summary, an explanation of how obesity could cause asthma has not been established. Moreover, most of the limited research is in adults, and the application of these findings to adolescents who do not undergo surgery is unclear.

Family and Peer Interactions

Adolescence is characterized by increasing separation from caregivers and increasing dependency on peers. Family well-being influences asthma in adolescents while severe asthma can reciprocally impact family functioning. The growing influence of peers on the adolescent can also influence asthma outcomes.

Separation from Caregivers

Emerging autonomy allows adolescents the potential for responsible self-management. However, the demands of managing a significant chronic illness can instead increase dependence on the family and caregivers at a time when an adolescent should be gaining more independence (Eiser and Berrenberg 1995). The desire for autonomy and independence may lead adolescents to consider caregiver input nagging, which may cause adolescents to avoid taking their medicine (Penza-Clyve et al. 2004). Medical personnel may hold parents accountable for adherence behaviors of their teenagers, while also encouraging adolescents to assume responsibility for their illness (Sawyer and Aroni 2005). Parents may feel accused of being overprotective when, from their perspective, they are fulfilling their parental obligations (Sawyer and Aroni 2005).

Impact of Asthma on Family

Chronic illness is not only a problem for the child or adolescent to endure, but also for the family. The presence of an adolescent with a chronic condition imposes an increased burden on the caregivers (Cadman et al. 1991). Given that the severity of chronic illnesses varies and that measures of family function are not standardized, it is not surprising that researchers' findings of the impact of such illnesses on family dynamics is not uniform (Suris et al. 2004). Some families adequately cope with this situation while others are overwhelmed by the problems brought on by the condition (Suris et al. 2004).

Since asthma is a chronic disease, it places increased demands on parental time and energy (Kurnat and Moore 1999). Lack of knowledge about the disease, fear of their child dying, and anxiety about their child's health contribute to increased levels of stress and anxiety among parents of asthmatics (Jerrett and Costello 1996). Parental loss of workdays owing to their children's asthma is substantial. During one 12-month study, nearly 30% of caregivers of asthmatic children lost workdays during the study because of their child's illness, and more than 13% of caregivers lost more than 5 days (Sherman and Milgrom 2005). Caregiver absenteeism significantly correlated with all components of asthma control (use of relievers, nocturnal symptoms, impairment of activities, and asthma crises) (Sherman and Milgrom 2005). A significant eightfold risk of losing more than 5 workdays by caregivers was observed when the child's asthma was poorly controlled (Sherman and Milgrom 2005). As indicated in the next section, how well the family copes with the child's asthma ultimately influences the asthma outcome.

Impact of the Family on Asthma

There is a tendency for families of severely asthmatic adolescents to have psychological disturbances (Chesson et al. 2004; Kaugars et al. 2004; Klinnert et al. 1994; Klinnert et al. 2001; Mrazek et al. 1999; Wamboldt et al. 1996). Klinnert et al. (2001) found that parenting difficulties early in a child's infancy predict asthma onset and persistence. The mental health status of a child's caretaker has also been shown to be a significant factor when predicting hospitalizations due to asthma in a study of 4–9 year olds (Weil et al. 1999). In a study of 115 children, aged 4–18, Chen et al. (2003a) found that repeat hospitalizations for asthma were associated with characteristics of a child's caretaker: a lower sense of mastery and being less emotionally bothered by their child's asthma. These investigators also found that a history of hospitalizations for asthma was associated with greater family strain, conflict, and financial difficulties.

Kaugars et al. (2004) hypothesized two pathways that may explain the relationship between family characteristics and asthma outcomes: (1) that family conflict and stressors can affect the asthma management behaviors of a family, and (2) that there may be an association between family characteristics, physiologic (hypothalamic pituitary axis and autonomic nervous system) functioning, and asthma outcomes. The relationship between family dynamics and stressors, physiologic factors, and asthma control needs further study in order to fully understand the complexities involved in pediatric asthma.

Influence of Peers

As adolescents separate from their families and form their individual identity, their reliance on peers increases (Bruzzese et al. 2004). These peer relationships and friendships play a critical role in the development of the adolescent's identity (Ladd 1999;

Radzik et al. 2002). Adolescents exchange ideas and feelings, and develop values, attitudes and behaviors with peers (Suris et al. 2004). Self-image also evolves under the influence of peers.

In children with chronic illness, the development of peer relationships and self-image issues may be in conflict with the demands of chronic illness treatment regimens or the disability itself (Suris et al. 2004). Furthermore, young people with chronic conditions may become excluded from their peer group, especially in those with taxing medical conditions or those that mark them out as very different (Manworren 1996). Difficulty with peers can lead to anxiety or emotional disturbance and may impact the teens' ability to manage their asthma.

Peer groups can either hinder or facilitate adolescents' asthma management (Bruzzese et al. 2004). As social relationships develop, adolescents may choose not to take medications in certain circumstances due to social barriers (McQuaid et al. 2003; Penza-Clyve et al. 2004). Whereas a younger child may feel less embarrassed in making a quick visit to the school nurse for medication, a teenager might not want to leave the lunchroom for fear of "standing out" (McQuaid et al. 2003). Adolescents may need to take their asthma medications in public places, which may be embarrassing (Slack and Brooks 1995). Thus, some teens with chronic lung disease may struggle with peer relationships because of having the fear of peer rejection and isolation occurring as a result of social, emotional and physical consequences of their underlying lung disease and its treatment (Fitzgerald 2001).

If adolescents with asthma are able to be part of peer groups that have positive attitudes regarding asthma, the outcome may be positive for the adolescent (Bruzzese et al. 2004). For example, when friends accept the potential need for visible treatment for asthma, adolescents are more likely to adhere to the treatment plans (Bruzzese et al. 2004). A small study assessing peer relationships in children with asthma demonstrated that asthmatic children (ages 8–13) had peer relationships that were equivalent to those of their classmates, although they were seen as being sicker and missing more school (Graetz and Shute 1995). Those children who experienced more hospitalizations were less preferred as playmates, perceived as more sensitive, isolated, and lonely (Graetz and Shute 1995).

The Influence of the Larger Community: Socioeconomic Status (SES) and Racial and Ethnic Disparities in Asthma Care in Adolescents

The social environment, that is, the community in which an adolescent lives, can have a profound effect on a teen's health (Leventhal et al. 2005). Race and socioeconomic resources significantly influence asthma outcome and the impact of each is usually difficult to separate from the other. Discrimination against racial and ethnic minorities influences access to socioeconomic resources, including health care. A recent Institute of Medicine report, Unequal Treatment (Smedley et al. 2003), found differences in health care provided to patients on the basis of their race-ethnicity even when access related factors such as patients' insurance status and income were controlled. That is, the poorer health outcomes seen in minority groups could be attributed, in part, to differences in the health care provided and to access to that care.

Access to healthcare in poor communities is more difficult to obtain than in more affluent communities. Availability of medical facilities, practices with specific expertise in caring for asthma, and pharmacies may be limited. Features of area medical practices such as the lack of evening hours may limit access. In a study of characteristics of primary care practices serving Medicaid patients, Lowe et al. (2005) found that emergency department use was lower in practices with evening hours and a lower ratio of number of active patients per clinician-hour of practice time. In some communities, there may be no accommodations made for language and cultural differences, which can impair communication. Lieu et al. (2004), in a prospective cohort study of Medicaid-insured children with asthma, found practice sites that promote cultural competence (e.g., recruits ethnically diverse and bilingual staff, offers training to minimize cultural barriers and promotes communication), use reports to clinicians (e.g., lists of asthma patients, registries that prompt clinicians about medications, feedback reports to clinicians, reminders to clinicians of guideline recommendations), and promote access and continuity (encourages appointments for preventive chronic asthma management, provides telephone advice including evenings and weekends, ensures primary

care follow-up after an urgent visit) gave higher quality of care.

Within the health care facilities, there is evidence that poor and minority patients including adolescents are less likely to get the same quality of care as white patients (Elster et al. 2003; Smedley et al. 2003; Wallace et al. 2004). Specifically with respect to asthma, several studies of Medicaid-insured children with asthma found that Black and Latino children had worse asthma status than white children but were less-likely to receive and use inhaled anti-inflammatory medication (Ferris et al. 2006; Lieu et al. 2002).

At the larger neighborhood level, there are other factors that may influence asthma outcomes. African-American and Latino children are approximately three times more likely than non-Hispanic white children to come from poor families (Leventhal et al. 2005). Families that are poor and minority, particularly those in urban areas, are more likely to live in poor neighborhoods (Leventhal et al. 2005). Such communities have fewer resources such as hospitals, high quality schools, public transportation, and grocery stores (Evans 2004; Atkins et al. 2006). Schools in poorer communities are likely to have less health education, and less availability of on-site nurses (Hillemeier et al. 2006). Children from these communities are more likely to be exposed to violence, which can impact their academic performance, and result in high rates of depression and disruptive behavior (Schwartz and Gorman 2003). Poorer neighborhoods may be targeted for more advertising of tobacco and alcohol; smoking may be more prevalent in these neighborhoods (Dell et al. 2005); thus, these teens are more likely to be exposed to smoking behavior.

Low SES has been associated in children with more frequent exposure to violence and other stressful events. Poor housing and living conditions can be stressful. One study found that children of Latino and African-American families in urban public housing communities are two to four times more likely to suffer from chronic physical and mental conditions than the general population (Bazargan et al. 2005). Exposure to violence predicted in a graded fashion more symptom days in children with asthma and more nights of lost sleep by their caretakers, even when controlling for SES, housing deterioration and negative life events (e.g., death of a family member) (Wright et al. 2004). Chen et al. (2006) demonstrated that, in children with asthma, lower SES was associated with higher levels of stress and threat perception. These findings were associated with increased production of interleukin-5 (IL-5), interleukin-13 (IL-13), and higher eosinophil counts.

Many studies on the relationship between SES and asthma focus on children over a large age span. There is a relative paucity of data aimed at clarifying this relationship specifically in adolescents. The contribution of community factors to health compared with individual and family factors requires further research not only in children, but also more specifically in adolescents. Provided the adolescent has access to medications like inhaled steroids and necessary health services, the impact of these individual, family and peer, and neighborhood/community barriers to asthma control are frequently mediated by adherence.

Adherence

The World Health Organization recently defined adherence to long-term therapy, as "the extent to which a person's behavior – taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider," Rand 1993). This definition emphasizes agreement and communication between patient and provider and stresses a broader range of activities in addition to medication taking. Adherence therefore involves self-management, but extends beyond a discussion of taking medication to include other behaviors like keeping appointments, refilling medications, and abstinence from smoking. Nevertheless, much of the available research on adherence in asthma including adolescents is centered on taking medication.

Although older children have been shown to know more about asthma and assume more responsibility for disease management than their younger counterparts (McQuaid et al. 2003), adherence in adolescents is poorer than for younger children (Bender et al. 2000a, b; McQuaid et al. 2003). In one study, electronic monitors were placed on daily asthma inhalers for 1 month and subjects were told that medication use was recorded (McQuaid et al. 2003). In the 14–16 year old subjects, the mean adherence calculated as the number of recorded daily doses divided by number of prescribed doses averaged over a month, was 42% ± 29%.

In considering the individual barriers presented earlier, the orientation of adolescents to the present

and their tendency to feel invulnerable are likely to limit the incentive for taking chronic medications like inhaled steroids. Concern about body image and fear of weight gain may motivate some adolescents to avoid taking oral or inhaled corticosteroids.

At the family level, taking medications may become part of the battle for independence with parents (Logan et al. 2003). Family habits, pressures, lack of cohesiveness, and upheaval are associated with low adherence (Bender 2006; DiMatteo 2004a, b). Mood disorders, high risk behaviors, and nonadherence tend to accompany one another and together make asthma control problematic (Bender 2006). In fact, deaths from pediatric asthma have been shown to be associated with denial of symptoms, poor asthma management and adherence, intense family conflict, and psychological dysfunction (Strunk et al. 1985).

Activities with peers may interfere with medication taking. If adolescents are engaged in an activity with peers that they do not want to interrupt, some may forget to take their medications (Penza-Clyve et al. 2004). More important, adolescents may not take medications because of concerns that they would be viewed unfavorably by peers if it was known that they have asthma or take medicine.

Minority and poor adolescents with asthma have been reported to be less likely to adhere to medication regimens. Cooper and Hickson (2001) found black youth less likely than white youth to fill a prescription for corticosteroids after an emergency department visit for asthma. Black and Hispanic children were shown to be significantly less likely than white children to use daily inhaled anti-inflammatory medication (Lieu et al. 2002). Emergency department use for asthma has been reported to be greater among black children than compared to white children, while black children were also less likely than were white children to have an office visit for asthma (Lozano et al. 1995). However, further research is necessary to completely understand the relative impact of the myriad of barriers to adherence that adolescents with asthma face at all levels (e.g., neighborhood stresses, family stresses, difficulty scheduling appointments and accessing health care).

Many health-related behavioral patterns formed in adolescence continue into adulthood (van Es et al. 2001). Therefore, intervening in adolescence has the potential to instill in youth a preventive style of asthma management that is likely to continue into adulthood (Bruzzese et al. 2004).

Unique Influences of Asthma on the Life of Adolescents

While previous sections have demonstrated the importance of the social environment on asthma control, reciprocally, there are unique features of adolescent life affected by asthma control: school, sleep, and exercise.

Influences of Asthma on School and Sports

Success in school is important for an individual's subsequent vocational and academic success and eventual financial independence (Suris et al. 2004). School experiences influence self-image (Harris et al. 2002); it is where peer pressure is applied, popularity or lack of it is experienced, romantic and platonic relationships emerge, and where classes and sports activities lead to success or failure. It may also be a place where teens may be exposed to violence, tobacco, and drugs, which if pursued can influence adherence and asthma control.

Across illness types, children and teenagers with chronic conditions are more likely than their healthy peers to miss school due to their condition or its treatment (Fowler et al. 1985; Suris et al. 2004). They are also more likely to skip school (Charlton et al. 1991; Suris et al. 2004). According to the National Health Interview Survey in 2002, children and adolescents of 5–17 years of age missed 14.7 million school days due to asthma and had more absences than nonasthmatic children (CDC/NCHS 2002b).

There is conflicting evidence about the impact of asthma on school performance (Fowler et al. 1992). Some studies show that children with asthma are at higher risk for problems with academic achievement (Fowler et al. 1992). US data from the National Health Interview Survey in 1988 suggest that after adjusting for age, sex, race/ethnicity, maternal education, and income, asthmatic children have similar risks of grade failure and suspension/expulsion, but increased risk of having a learning disability (Fowler et al. 1992). Also, children with asthma from low-income families had twice the odds of grade failure when compared with well-equipped children (Fowler et al. 1992).

Sleep disturbance is more common in adolescent asthmatics (Yeatts and Shy 2001). Diette et al. (2000)

determined that the presence of nocturnal asthma symptoms in children and adolescents was associated with decreased school attendance and performance, as well as with missed work in their parents. Thus, it has been hypothesized that asthma, by impairing a child and adolescent's sleep patterns, can result in school absence which threatens academic and career success.

Studies reporting low school performance or learning disabilities in children and adolescents with asthma have often relied on subjective measures, such as parental surveys about their child's school performance (Diette et al. 2000; Fowler et al. 1992). Many parents believe that asthma or asthma medications can cause learning problems in their child, when in fact these children's objective scores on achievement tests were as high as those of their peers (Roder et al. 2003). However, when objective measures have been used to evaluate school performance via standardized tests, the results generally do not support the conclusion that asthma or its treatment places children at risk for a learning disability or low school performance (MacLean et al. 1992; Roder et al. 2003; Silverstein et al. 2001). In fact, children and adolescents with asthma tend to have higher standardized scores than national norms (Silverstein et al. 2001). Nevertheless, physicians should ensure that families are aware of the potential impact of asthma on academics, and school absenteeism and encourage appropriate planning and coordination between family and school (LeBlanc et al. 2003).

Exercise-Induced Bronchospasm (EIB) in the Adolescent

Uncontrolled asthma interferes with participation in sports or other physical activities, thus compromising relations with peers (Bruzzese et al. 2004). Sports and physical activity play an important role in the life of an adolescent, yet adolescents with asthma are 20 times more likely to have limitations on physical activity than asymptomatic adolescents (Yeatts and Shy 2001). Approximately 50–90% of all individuals with asthma have airways that are hyper-reactive to exercise and up to 38% of athletes have been reported to have EIB (Rundell and Jenkinson 2002). Thus, individuals with asthma may limit their participation in aerobic activities (Garfinkel et al. 1992), which may impair their quality of life (Hallstrand et al. 2003).

It has been reported that asthmatics as a group have a decreased level of physical fitness because of their relative inactivity (Mannix et al. 2004). Interestingly, this limited fitness level in asthmatic subjects seems not to be related to their degree of obstruction, but rather to their decreased levels of habitual activity (Lucas and Platts-Mills 2005). Therefore, exercise conditioning in asthmatics is said to be an important part of the management and treatment for all cases of asthma (Lucas and Platts-Mills 2005). The benefits of conditioning on asthma are both subjective (increased participation in activities, improved emotional status, and decreased intensity of wheezing attacks) and objective (improved running performance and increased aerobic fitness) (Lucas and Platts-Mills 2005).

EIB may go unrecognized if an adolescent is reluctant to report symptoms to their parents or coaches or to seek a physician's advice (Rupp et al. 1993). Sometimes symptoms of EIB such as coughing, wheezing, and chest tightness are perceived as normal responses to exercise (Mannix et al. 2004). In addition, because athletes are generally fit and healthy, the presence of a significant medical problem may not be considered (Parsons and Mastronarde 2005). It is important to note that occasionally, a death occurring in close association with a sporting event or physical activity is attributed to asthma (Becker et al. 2004). On the other hand, adolescents such as those who are obese or otherwise out-of-shape may experience shortness of breath with exercise that is then incorrectly attributed to asthma.

Caring for the Adolescent with Asthma

Adolescents must have a voice in their own health care (Ginsburg et al. 2002). That is, adolescents, particularly those with chronic disease, want their physicians to be honest with them, allow them the opportunity to participate in their own care, and have their viewpoints and concerns taken seriously (Britto et al. 2004; Ginsburg et al. 1995). The characteristics of the provider are a major determinant as to whether an adolescent will seek preventive care (Ginsburg et al. 2002). Adolescents want a strong interpersonal relationship with their health care provider, a sense of emotional and physical safety, and a trustworthy provider who can offer counseling, privacy (Ginsburg et al. 2002) and clear communication (DiMatteo et al. 2004). Indeed, effective communication has been shown to promote adherence (DiMatteo et al. 2004b).

Once trust and communication are established, providers should explore the psychosocial environment of the adolescent with asthma as summarized in Table 12.1. The environment should be assessed at the level of individual factors, family and peer dynamics, as well as community and neighborhood characteristics. For example, on an individual level, the adolescent should be asked about risk-taking behavior, mood or behavioral disorders (Smith and Shuchman 2005), sleep quality, body image, risk factors for obesity, activity limitation, and adherence. It is important to assess the psychological functioning of the adolescent particularly when asthma is severe. Family interactions, caretaker mental health (DiMatteo et al. 2004; Kaugars et al. 2004; LeBlanc et al. 2003; Weil et al. 1999), and peer dynamics also must be explored. On the community level, the teen's progress in school, school attendance, and other resources within the larger community in which the teen lives should be analyzed.

Table 12.1 Factors to consider in the psychosocial assessment of adolescents with asthma

Individual factors
Trends in physical growth, development, and onset of puberty
Defining characteristics of the adolescent's identity
Cognitive skills, ability to problem-solve
Perception of invulnerability
Impulse control
Risk-taking behavior such as
Smoking and the use of other substances
Unprotected sexual activity
Unsafe driving
Perception of body image
Presence of obesity and eating disorders
Activity limitation
Mood disorders and depression
Psychological stressors
Sleep quality
Adherence
Family and peer relations
Functioning within the family
Gaining independence from the family
Availability of family resources: financial, social, environmental
Caretaker mental health
Quality of peer relationships
Community and neighborhood resources
School performance and attendance
Availability of resources for health, learning, recreation, transportation
Membership in religious and other community groups
Exposure to violence

Adolescents comprise a unique patient group in that they are undergoing a transition from childhood to adulthood, while experiencing rapid changes in cognitive and physical development. As in all chronic diseases, risk taking behaviors, peer group pressures, family relationships, psychological stressors, socioeconomic status, and race/ethnicity can all potentially play a role in complicating disease management. During a single clinic visit, it can be a daunting task to address all of the needs of an adolescent patient. Realistically, establishing a relationship with effective communication between the adolescent and provider can take a number of visits. This is particularly important for the adolescent severely affected by asthma. Such a physician–teen relationship will benefit the adolescent for years to come and facilitate a smooth transition from pediatric to adult centered health care. At the same time, this relationship will be intensely rewarding for the clinician.

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