

Chapter 12

Improving Adherence and Promoting Behavioral Change



Marisa Perez-Reisler

Definition and Impact of Adherence in Medical Settings

Treatment adherence consists of behaviors employed to follow recommendations by healthcare professionals with the goal of appropriate management or primary prevention of a disease state. Medication compliance is most commonly associated with treatment adherence. Other examples include lifestyle and behavior changes, such as following specific diet or exercise recommendations, complying with referrals to specialists and adhering to primary preventive practices like vaccinations. Identification of adherence problems is essential for medical providers as part of ongoing medical treatment and planning. Nonadherence can lead to significant medical repercussions and high medical costs (Brody 2017). Multiple factors contribute to treatment nonadherence. Among these factors are forgetfulness, cost, medication side effects, health-belief models, illness response and severity, as well as a myriad of intersecting psychosocial and healthcare system factors. Addressing these issues is a critical component to improving adherence.

Nonadherence in Adult Populations

Treatment nonadherence is common. One study showed adherence rates of approximately 50% for acute, short-term antibiotic administration in the treatment of respiratory tract infections. It is well-established that adherence rates decrease as dosing frequency increases in the adult population (Claxton et al. 2001). Table 12.1 shows

M. Perez-Reisler (✉)

Department of Psychiatry, University of Hawai'i John A. Burns School of Medicine,
Honolulu, HI, USA

e-mail: marisape@hawaii.edu

Table 12.1 Adherence rates inversely related to dosing frequency of medication (adapted from Claxton et al 2001)

Dosing schedule	Adherence rates
Daily	79%
BID	69%
TID	65%
QID	51%

that daily dosing of a 5-day course of antibiotics has an adherence rate of 79%, which decreases in inverse proportion to the frequency of daily dosing, to 59% with four times daily dosing. In chronic medical conditions, which can involve prolonged or lifelong medication courses, multiple agents, and additional behavioral recommendations, adherence rates are lower, around 50% (Sabaté 2003). The morbidity and mortality associated with treatment nonadherence as well as the financial costs are large. These costs related to nonadherence are termed “healthcare waste” and account for 3–10% of total US healthcare costs (Iuga and McGuire 2014).

The remainder of this chapter will focus on nonadherence in pediatric medical care, where adherence rates for both acute and chronic illnesses are lower compared to adults. There are multiple contributing factors to the lower adherence rates in pediatrics, including the added variable of having both the patient and their family or caregiver involved and the medical provider needing to understand the developmental issues at stake for appropriate communication about illness education, treatment management, and anticipatory guidance and prevention. Discussion about modifiable targets of intervention will be illustrated utilizing case vignettes.

Nonadherence in Pediatric Populations

In pediatric populations, the nonadherence rates are even higher than for adults, with one study noting that 50–88% of children and adolescents do not adhere to their medication regimens (Logan et al. 2003). In acute pediatric illnesses such as otitis media and strep pharyngitis, adherence rates vary widely anywhere between 18 and 95% (Wu and Roberts 2008). In chronic pediatric illnesses, the adherence rate is less than 50% (Osterberg and Blaschke 2005). As healthcare professionals, how do we deal with this ubiquitous challenge, which is a significant contributor to worsened health outcomes and a large financial and public health burden? (McGrady and Hommel 2013).

It is vital for primary care and behavioral health providers, as well as other specialists working with child and adolescent populations, to understand factors involved with adherence and the impact on treatment outcomes. More specifically, we will be dealing with adherence for chronic pediatric illnesses including asthma, diabetes, juvenile rheumatoid arthritis (JRA), cystic fibrosis (CF), seizure disorders, obesity, solid organ transplants, bone marrow transplants, cardiac malformations, cerebral palsy (CP), human immunodeficiency virus (HIV), and congenital genetic and developmental disorders. Due to advances in healthcare, greater numbers of

children survive acute lymphocytic leukemia (ALL), congenital heart conditions, and bone marrow or solid organ transplants. These patients' treatment adherence is vital for their survival and quality of life, despite studies showing that adherence rates for these chronic conditions are no better than in other pediatric populations (Rianthavorn et al. 2004).

Additionally, adherence rates in pediatrics are lower compared to adults in both low-risk illnesses, where health consequences are minimal or cumulative, and serious-risk illnesses, where medical treatment is mitigating the condition, but full remission is not expected (LaGreca and Bearman 2003). In the first case, many years need to pass for any manifestations of illness, and treatments may not show any demonstrable difference in outcome in the short term. For serious illnesses, patients and/or parents may believe that treatment would result in only limited impact on health outcomes and therefore may not be optimally compliant.

Barriers for Pediatric Patients

Adherence to treatment in pediatric patients is a complex dynamic. As medical providers, understanding barriers to address for patients and their families and educating about the challenges observed with specific illnesses are important to effectively engage patients and families and promote treatment adherence (Fig. 12.1).

Adherence barriers can be divided into categories: patient/family factors, illness factors, treatment factors, and healthcare system factors. These factors are all well-described in the literature. Patient/family factors include patient's developmental stage, cognitive skills, health-belief model, self-efficacy or self-management skills, psychosocial supports, environment, and patient/family psychological factors (DiMatteo 2004; LaGreca and Bearman 2003). Psychological factors include illness distress, underlying mood and anxiety or other psychiatric disorders, stress levels, history of trauma, communication and coping skills, as well as self-esteem and implicit and explicit bias. One significant psychological factor particularly present in chronic pediatric illnesses is "burnout" most notably found where treatment regimens require significant lifestyle changes and complex medication dosing over a long-term course. Patient and family burnout is a well-known factor associated with adherence problems (Warner and Hauer 2009).

Illness factors are specific to the type of illness and its symptom severity and other manifestations. Treatment factors include length of time required, frequency of dosing, effectiveness of treatment, invasiveness (difficulty of medication administration), and lifestyle changes including diet, exercise, and activity restrictions or modifications. The effect of treatment on illness and side effects are additional contributors to adherence rates. Healthcare systems can also promote or worsen adherence based on ease of enrolling in insurance coverage, copayments, as well as partnership with patients and providers and availability of other programs that might help with patient reminders or other system issues involved in adherence. Provider factors, including age, race/gender concordance or discordance, communication

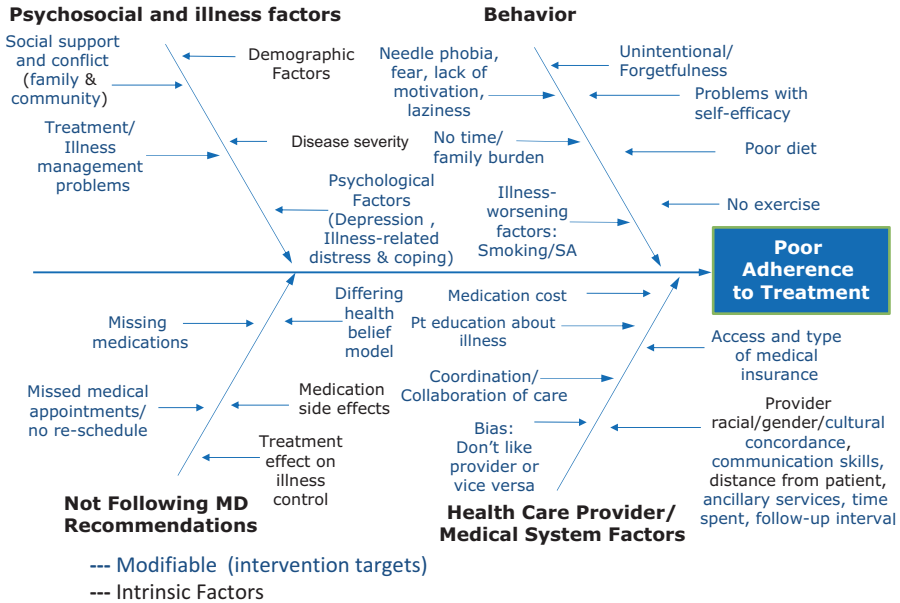


Fig. 12.1 Barriers to adherence. Fishbone diagram showing factors leading to poor adherence including: psychosocial and illness factors, behaviors and health care system factors

skills, explicit and implicit bias, and availability of ancillary help for education, medication administration, and appointment reminders, are additional factors that can affect a patient’s adherence. Of the factors discussed above, while some are unmodifiable, many are modifiable factors that can be targets for intervention (see Table 12.2).

An emerging field of research into treatment adherence involves the concept of implicit bias and its effects on healthcare outcomes. Implicit bias is a largely unconscious and intrinsic automatic bias that every person, including physicians, has toward other people based on outward physical characteristics such as perception of age, race, skin color, gender, and class. It differs from explicit bias in that it is covert and typically unacknowledged. Implicit bias may be based on demographic and physical categories for provider and patient, including age, gender, race, cultural background, nationality, sexual orientation, socioeconomic class, and physical attributes (including weight, grooming, and dressing habits). Because adherence is a complex behavior, unconscious or implicit bias can be a dynamic factor due to the largely unacknowledged role it can exert in affecting both the patient and provider’s attitudes, beliefs, and behaviors during and after treatment encounter. While the presence of implicit bias is well-established, its effects on adherence and healthcare outcomes have not been completely understood and are only recently being studied. A study by Blair et al. in 2014 did not find any significant effect of intrinsic bias either treatment changes or outcomes of patients with hypertension (Blair et al. 2014). A meta-analysis by FitzGerald and Hurst in 2017 showed that both healthcare profes-

Table 12.2 Adherence promotion interventions

Classification and intervention types
<i>Educational</i>
<i>Behavioral</i>
Parental monitoring
Cognitive behavioral therapy
Dialectical behavioral therapy
Operant-learning procedures
Self-management
<i>Psychosocial</i>
Family-based interventions
Parent guidance
Multi-systemic treatment
Cognitive behavioral therapy
Motivational interviewing
Dialectical behavioral therapy
<i>Organizational approaches</i>
Provider-driven: simplify regimen; use auto-delivery systems
Pharmacist driven
Reminder systems: text message, medication reminder applications
Case Manager
<i>Multi-component interventions</i>

sionals and patients have implicit bias and that these may correlate with a negative clinical interaction. This in turn may be postulated to have a detrimental effect on a patient's attitudes and behaviors toward their treatment plan, although a direct causal relationship has not been established (FitzGerald and Hurst 2017). Importantly, awareness of the existence of unconscious bias and self-awareness as patients and/or medical providers can help change attitudes and implement changes that can mitigate the disparities it can cause when otherwise it would not be identified and addressed. Additionally, perspective-taking or understanding a patient's viewpoint and individuation, taking in account the patient's characteristics rather than that of their identified group, may minimize the impact of intrinsic bias (Chapman et al. 2013).

Understanding the Metrics

In the medical literature, metrics employed to quantify adherence rates vary among studies, making it somewhat difficult to make direct comparisons. For example, in some studies, pharmacy refills are used to quantify medication compliance, but since these tallies are devoid of clinical context, medication intolerance due to side effects is measured as noncompliance. To account for other ways to measure adherence, other studies utilize questionnaires or direct data, including blood levels,

glucometer readings, and electronic measurements that may avoid this potential miscount but have their own inherent metric errors. Use of at least two metric systems can help improve the correlation for errors inherent in each system (Bhatia et al. 2017) as currently there is no “gold standard” measure for adherence.

Role of Consultation-Liaison Psychiatry

In primary care settings, behavioral noncompliance constitutes the largest reason for psychiatric consultation (16.2%), and on inpatient wards it is the second highest concern for consultation (13%) (Campbell and Cardona 2007). Additionally, depression is a known risk factor for adherence problems, with depressed patients being three times as likely to be nonadherent as compared to nondepressed patients (DiMatteo et al. 2000). Consultation-liaison psychiatrists and other behavioral health specialists can be valuable team members identifying and recommending a plan to address adherence barriers, including psychiatric illnesses, in patients and/or their parents. Other common psychiatric symptoms and disorders that can negatively impact adherence include anxiety, posttraumatic stress disorder, and substance abuse. Identifying a depressed patient (or caregiver/family) and screening for comorbid disorders with treatment recommendations could significantly improve a patient’s adherence rate. Depending on one’s scope of practice, a consulting psychiatrist could potentially provide short- or long-term direct follow-up care, possibly in the same medical facility as the referring provider. This arrangement can optimize continuity of care and collaborative treatment.

Case Vignette 12.1

Joey is a 7-year-old boy with eczema, allergic rhinosinusitis, and mild persistent asthma with several emergency department visits this winter for asthma exacerbations, usually triggered by viral upper respiratory infections. He lives with his mother, grandparents, baby brother, and pet dog. His grandfather is a smoker. He takes a short-acting beta-agonist (SABA) as needed for asthma exacerbations, fluticasone nasal spray, and inhaled corticosteroid (ICS) twice daily. Recently, his mother lost her job and medical insurance coverage and was unable to buy his daily inhaled steroids and fluticasone, so she has been giving him his medication only when he is symptomatic. He has stopped playing soccer, as he feels too tired, and has missed several school days over the winter due to asthma flares. He wishes he could play soccer again and feels he is “not as good” as his other friends who still play, causing him to feel sad sometimes. Joey’s case is discussed in a collaborative primary care/integrated behavioral health team meeting where you are present as a consultant.

Improving Adherence in Pediatric Asthma

Like in other chronic illnesses, adherence rates in pediatric asthma fluctuate between 30 and 70%, averaging approximately 50% (Bender 2002). In addition to added direct costs for controlling asthma flares, nonadherence may lead to medication

dose escalations or switching medications especially when nonadherence is not identified and mislabeled a medication failure (Bender and Bender 2005). These changes can lead to worsened outcomes, as the patient may be inadvertently given a higher dose than needed with resultant side effects, as well as higher resource utilization. Monitoring treatment adherence is an essential component of good medical care. Multiple strategies have been identified to improve adherence for asthma and are listed in Table 12.3 (Lemanek et al. 2001). In the case example, asthma education includes identifying Joey’s asthma triggers, particularly modifiable ones, and the steps the family must take to minimize his exposure to them. It is important to understand this family’s health-belief model, including their knowledge about the asthma regimen medications and the need to take them daily, and to insure communication with the provider if barriers do not allow them to continue this plan. Shared treatment decision-making, which addresses barriers to treatment, has been shown to improve adherence (Wilson et al. 2009). Poor control of asthma has resulted in Joey participating less in extracurricular sports. Determining methods to improve his symptom control can be framed in relation to his daily goals for school and sports participation. Determining whether he is allergic to his pet dog, or at least reducing his contact with the pet while investigating this association, can be an initial goal for the provider to address with the family. Additionally, helping his grandfather with a referral for smoking cessation could also be identified as another modifiable factor for symptom control. Another alternative would include advice on risk reduction for his exposure to secondhand smoke, especially while his grandfather is working on decreasing or discontinuing cigarette smoking. Referral for assistance in applying for publicly funded medical insurance, in finding cheaper alternatives for his daily medications, and in accessing resources to aid in pick-up

Table 12.3 Empirically supported treatments (ESTs) in pediatrics

Illness and intervention types
<i>Asthma</i>
Organizational approaches
Educational strategies
Behavioral strategies or combination
Multi-component treatment ^a
<i>JRA</i>
Behavioral strategies
Educational strategies
<i>Diabetes</i>
Operant-learning procedures
Multi-component treatment/ self-management training
Cognitive behavioral/self-regulation procedures

Adapted from Lemanek et al. 2001

^aFuture research needed to determine efficacy

of medications could be a key way for the provider to improve Joey's asthma control. The family had managed his asthma successfully when the medications were available, so organizational strategies can be discussed for review, but are unlikely to make significant changes in his case. Addressing another modifiable risk factor for worsened asthma control, assessment of comorbid depression, or anxiety affecting Joey or his caretakers can also help improve treatment adherence. In this case, Joey's asthma symptoms directly affect his ability to participate in sports but also lead to self-esteem changes as he compares himself to his peers. If his asthma symptoms do not improve, the negative effects on his self-esteem can lead to more significant mood and anxiety symptoms. Developmentally appropriate illness education that includes anticipatory guidance and prevention geared toward both the family and patient is key to encouraging his autonomy and feeling of self-control. Also, inquiring about the effect of his mother's job loss on the family and its effect on his treatment may yield additional ways to optimize his care. For asthma of greater severity, multicomponent treatment is a helpful tool. For adolescent children with text message capability, use of text reminders can be a powerful aid for improving treatment adherence (Petrie et al. 2012).

Case Vignette 12.2

Emma is a 13-year-old female with Type 1 diabetes mellitus (T1DM) diagnosed at age 6 and a recent hospitalization for diabetic ketoacidosis last month. Her most recent hemoglobin A1C level of 11 is elevated. You were asked to consult for concern of possible depression and treatment adherence issues impacting her diabetes care. Upon chart review and interview of the patient, you learn the following:

Emma lives at home with both her parents. She explains she is struggling with her 8th grade coursework and "feels stupid" since she is in danger of failing this year. She is tearful, recently having superficially scratched her wrists after an argument with her parents. She denied any suicidality, but sometimes feels she does not have a good reason to be alive. She reports that for several weeks to months, she rarely checks her finger-stick glucose level at school and only occasionally at home. Prior to the start of the school year, she was able to independently manage her diabetes, with her parents needing to supervise her only on rare occasions. Since summertime, her parents noted she was more withdrawn or angry at home, and they had more difficulty communicating with her. This change coincided with the family moving neighborhoods and schools and complaints that she did not have any friends at her new school.

In this case example, we are being asked to identify barriers to Emma's adherence to her diabetes care. T1DM is a complex medical illness where multiple components, including glucometer monitoring, sliding scale insulin administration, dietary routines, exercise, and self-care, are necessary for optimal control (LaGreca and Mackey 2009). In addition to information about her specific treatment recommendations, other factors for the consultant to consider are age, gender, family dynamics and conflicts, socioeconomic level, comorbid illnesses and disease severity, as well as response of disease to treatment. In her specific example, we would also get information about her level of functioning at home and school, her ability to self-monitor her treatment, and her level of parental supervision. The family health-belief model is an additional important factor in our assessment. Some factors associated with better health and glycemic control include increased frequency

of blood glucose monitoring, lower family conflict around diabetes, and better self-management (Rohan 2015). All three of these factors are problematic in Emma's case and can be targets for behavioral intervention.

Despite Emma having become self-sufficient with her diabetes care in the past, the recent stressors have triggered depressive symptoms, impairing her ability to independently manage her healthcare needs. Having either Type 1 or Type 2 diabetes mellitus doubles the risk (in comparison to the general population) for depression (Lustman and Clouse 2005). Concomitant depression, through lack of motivation, guilt about burdening others, or hopelessness, can hamper youths' ability to communicate effectively with family members or to request additional help from school staff. Poor glucose control can also worsen mood, energy, and cognitive abilities (Sommerfield et al. 2004). As a young teenager, Emma is also in a developmental stage where acquiring self-sufficiency in caring for her own needs, including some of her diabetes management, is expected by her family and healthcare professionals. This transition toward increased self-reliance is a vulnerable period for adherence in adolescents (Warner and Hauer 2009). This vulnerability is in part because her treatment requires constant adjustment of her daily activities and schedule during a developmental phase where having diabetes may become a conflict for typical adolescent goals, such as "fitting in" and developing strong peer relationships. Mindful of the significant intervention required for successful diabetes care, the consultant should explore with her and her family what treatment component she can initiate responsibility for and should help the family to ensure that all aspects of her medical care are prioritized. Brief or occasional vacation periods, similar to a respite period, where a caregiver can become the central administrator of her medical treatment, can also be used to minimize burnout from the constant vigilance necessary for diabetic treatment (Warner and Hauer 2009). Reinforcing her self-efficacy skills for components of treatment she is managing may include providing additional positive encouragement and illness education. Additionally, indirectly assessing compliance and addressing questions or barriers that arise would have significant payoffs in improving her adherence rate. Monitoring her adherence more closely, by increasing office visits or more facilitating outreach and communication with her healthcare provider for blood glucose monitoring, would be indicated given the developmental transitions of adolescence (Taddeo et al. 2008).

Screening for eating disorders or disordered eating is important in adolescent girls with T1DM because disturbed eating patterns are frequently observed, although eating disorder rates are not higher than in the general population (LaGreca and Mackey 2009). In some cases, nonadherence, particularly when related to insulin, can be due to reluctance to gain weight (LaGreca and Mackey 2009). Nonadherence or misuse of insulin also must be closely monitored and considered a type of self-harming behavior, particularly if depressive symptoms including suicidal ideation are present. For self-harming behavior, dialectical behavioral therapy strategies, to improve affective regulation, distress tolerance, and interpersonal effectiveness, can be useful for improving adherence. In this case example, use of a mood diary card can be a helpful technique for monitoring the frequency of compliance with finger sticks and insulin injections. Ensuring a good therapist-patient relationship by

maintaining an optimistic yet pragmatic problem-solving approach is important for the patient to acquire further self-efficacy skills. In other cases, motivational interviewing can be utilized to further elucidate the patient's understanding of and commitment to the medical treatment plan. Especially for adolescents managing their diabetes for several years, maintaining consistency and motivation to adhere to their treatment regimen can become problematic, and motivational interviewing allows use of techniques to further engage and motivate patients to participate or address gaps in coping and adaptation to self-care with family members. Motivational interviewing strategies include a nonjudgmental stance and exploration of underlying motivations or problem areas leading to poor adherence.

Emma can also benefit from a multicomponent intervention and operant learning procedures to address adherence problems, as both have shown efficacy as interventions (Hood et al. 2010; Kahana et al. 2008; Lemanek et al. 2001; Taddeo et al. 2008). Operant learning that involves reinforcements such as token incentives that are accumulated on a weekly basis when diabetes treatment goals are met has been shown to improve adherence in adolescents (Lemanek et al. 2001). Referral to a psychologist and/or psychiatrist for evaluation for depressive symptoms, ideally with possibility of collaborative care with the medical provider, will further address adherence barriers related to mood and behavior that are impacting diabetes self-care in her case. Including both an individual- and family-based approach has shown good evidence for improving family conflict and treatment adherence in adolescents (Berg et al. 2008; Wysocki et al. 2008). Education to reinforce both her individual and family's knowledge related to diabetes and illness management can address both the knowledge-based and communication barriers within her family system (Whittemore et al. 2010 and Rohan 2015). Some important points to discuss with Emma and her family is that being female and having recently gone through puberty are two known risk factors for future diabetes-related complications (Rohan 2015). Having a diagnosis of T1DM for a longer period is also associated with worsening self-management (Hood et al. 2010). If no improvement occurs, or for high-risk individuals, multisystemic therapy is a more intensive intervention shown to improve diabetes adherence (Ellis et al. 2005). Identifying some of the modifiable risk factors involved in Emma's diabetes adherence problem can prove useful to develop individually tailored brief questionnaires that can help her provider understand how to prioritize resources associated with improving her diabetes adherence. These assessments can include self-efficacy screens and mood screens, along with her finger-stick glucose and follow-up hemoglobin A1C levels, to determine progress on treatment adherence. Facilitation of data collection and follow-up information by a diabetic nurse educator, social worker, or nurse practitioner can greatly aid endocrinologists or pediatricians managing these follow-up visits.

In T1DM, operant learning procedures, multicomponent treatments, self-regulation, and CBT have established efficacy and are mainstay therapies that the mental health provider can utilize (Kahana et al. 2008; Lemanek et al. 2001) for addressing adherence barriers. Additionally, some components of dialectical behavioral therapy (DBT) or motivational interviewing (MI) are other evidence-based therapies that may prove be helpful for behavioral activation (LaGreca and Bearman 2003).

Improving Adherence in Acute Lymphocytic Leukemia

Besides diabetes and asthma, another well-studied chronic illness in the pediatric population is acute lymphocytic leukemia (ALL). A recent study by Bhatia et al. (2017) revealed that adherence rates for a 2-year course of once-daily 6-mercaptopurine (6MP) are over-reported in ALL patients enrolled in their study. For effective treatment, 95% of doses must be taken. The study used patient and parent self-questionnaires and employed electronic microchips on pill bottles for correlation between questionnaires and actual dose-taking. They found that up to 84% of patients were over-reporting their medication compliance on self-reports, with 23.6% of the patients who were over-reporting medication doses taken having the highest non-compliance rates in the study. This finding is concerning due to risk of relapse and highlights the need for oncologists and pediatricians to actively monitor treatment adherence with measures other than self-report. Forgetfulness was identified as the primary barrier to medication adherence. Since this study was completed, oncologists at the medical center are using text message reminders and requesting texts back from parents to improve parent vigilance methods (Fitzmaurice 2017).

Use of New Technology to Monitor and Promote Adherence

Both eHealth and mHealth are terms used to describe new technologies used in healthcare delivery. Examples include electronic monitoring; short message service (i.e., text messaging); Internet-based, mobile medical applications; and illness-specific devices (Wu and Hommel 2014). Diabetes care can include continuous insulin monitoring and administration (insulin pump) as a treatment consideration. There is also a specific glucometer, iBGStar, that connects to a smartphone application for communication between the patient/family and their doctor (Wu and Hommel 2014). While these technologies are very promising, barriers to implementation still exist, including patient and provider access to these platforms or devices as well as ability to engage in use of a new system.

Healthcare System Changes and Financial Costs of Nonadherence

In addition, US healthcare reform proposes a payment schedule based on outcome results, emphasizing even more the role of healthcare professionals in the responsibility of our patient's behaviors toward treatment. This type of proposed insurance system also can create additional incentives as well as barriers in adherence outcomes. For example, reimbursements or financial incentives that can improve care coordination, improvements in data sharing across EHRs, and patient incentives can all facilitate adherence monitoring and rates (Cutler and Everett 2010). Further

research is needed to find out how the bundling of insurance payments via accountable care organizations and capitated costs might affect adherence. On the one hand, providers are incentivized to monitor and improve patient's adherence to treatment. On the other hand, these changes might create a system where healthcare providers and organizations refuse to take patients with more serious health conditions.

Conclusion

Pediatric medical practitioners are at the front lines in managing patients' illnesses. It is imperative to remember that nonadherence is a common and significant problem. Furthermore, developing an approach to screen for adherence issues with any recommended medical treatment is critical. Even in the earliest phases of care, education, anticipation of difficulties, and open communication lines are important for patients and families to develop confidence in exploring and reporting any problems that could affect the treatment. Understanding the developmental phases of childhood and adolescence, family health-belief models, the existence of bias, both implicit and explicit, and current family functioning in regard to the child's illness and treatment is vital for maintaining family-centered care that addresses potential adherence barriers. Collaboration with ancillary staff and mental health professionals when needed is also a helpful intervention.

Follow-up visits should consistently include methods to monitor for adherence as well as a depression screen. Given the over-reporting of adherence on self-reports, practitioners should consider having two types of data to better correlate their patient's adherence rates. In the case of diabetes, a diary and the glucometer readings would provide good backup on reliability of the reporting patient and family. Other emerging technologies, including medication reminder apps or text message systems, can be used with self-report or retrospective reporting.

Importantly, awareness of adherence patterns in our pediatric populations allows us to implement developmentally appropriate family-centered interventions.

References

- Bender, B. G. (2002). Overcoming barriers to nonadherence in asthma treatment. *The Journal of Allergy and Clinical Immunology*, *109*, S554–S559.
- Bender, B. G., & Bender, S. E. (2005). Patient-identified barriers to asthma treatment adherence: Responses to interviews, focus groups, and questionnaires. *Immunology and Allergy Clinics of North America*, *25*(1), 107–130.
- Berg, C. A., et al. (2008). Role of parental monitoring in understanding the benefits of parental acceptance on adolescent adherence and metabolic control of type 1 diabetes. *Diabetes Care*, *31*(4), 678–683. <https://doi.org/10.2337/dc07-1678>.
- Bhatia, S., et al. (2017). Comparison of self-report and electronic monitoring of 6MP intake in childhood ALL: A children's oncology group study. *Blood*, *129*(14), 1919–1926. <https://doi.org/10.1182/blood-2016-07-726893>.

- Blair, I. V., Steiner, J. F., Hanratty, R., et al. (2014). An investigation of associations between clinicians' ethnic or racial bias and hypertension treatment, medication adherence and blood pressure control. *Journal of General Internal Medicine*, 29(7), 987–995. <https://doi.org/10.1007/s11606-014-2795-z>.
- Brody. (2017). The cost of not taking your medicine. *NYTimes*. <https://nyti.ms/2psUF6a>. Accessed 17 Apr 2017.
- Campbell, J., & Cardona, L. (2007). The consultation and liaison processes to pediatrics. In A. Martin & F. Volkmar (Eds.), *Lewis's child and adolescent psychiatry: A comprehensive textbook* (4th ed., pp. 912–920). Philadelphia: Lippinkott Williams & Wilkins.
- Chapman, E. N., Kaatz, A., & Carnes, M. (2013). Physicians and implicit bias: How doctors may unwittingly perpetuate health care disparities. *Journal of General Internal Medicine*, 28, 1504. <https://doi.org/10.1007/s11606-013-2441-1>.
- Claxton, A. J., Cramer, J., & Pierce, C. (2001). A systematic review of the association between dose regimens and medication compliance. *Clinical Therapeutics*, 23, 1296–1310.
- Cutler, D. M., & Everett, W. (2010). Thinking outside the pillbox – medication adherence as a priority for healthcare reform. *NEJM*, 362(17), 1553–1555.
- DiMatteo, M. R. (2004). Social support and patient adherence to medical treatment: A meta-analysis. *Health Psychology*, 23(2), 207–218. <https://doi.org/10.1037/0278-6133.23.2.207>.
- DiMatteo, M. R., Lepper, H. S., & Croghan, T. W. (2000). Depression is a risk factor for non-compliance with medical treatment meta-analysis of the effects of anxiety and depression on patient adherence. *Archives of Internal Medicine*, 160(14), 2101–2107. <https://doi.org/10.1001/archinte.160.14.2101>.
- Ellis, D. A., et al. (2005). Use of multisystemic therapy to improve regimen adherence among adolescents with type 1 diabetes in chronic poor metabolic control a randomized controlled trial. *Diabetes Care*, 28(7), 1604–1610. <https://doi.org/10.2337/diacare.28.7.1604>.
- FitzGerald, C., & Hurst, S. (2017). Implicit bias in healthcare professionals: A systematic review. *BMC Medical Ethics*, 18, 19. <https://doi.org/10.1186/s12910-017-0179-8>.
- Fitzmaurice, S. (2017, February 2). *Study: Children, parents over-report leukemia treatment adherence American Society of Hematology*. Accessed on 1 Dec 2017 from <http://www.hematology.org/Newsroom/Press-Releases/2017/7045.aspx>
- Hood, K. K., et al. (2010). Interventions with adherence-promoting components in pediatric type 1 diabetes meta-analysis of their impact on glycemic control. *Diabetes Care*, 33(7), 1658–1664. <https://doi.org/10.2337/dc09-2268>.
- Iuga, A., & McGuire, M. (2014). Adherence and health care costs. *Risk Manag Healthc Policy*, 7, 35–44. <https://doi.org/10.2147/RMHP.S19801>.
- Kahana, S., Drotar, D., & Frazier, T. (2008). Meta-analysis of psychological interventions to promote adherence to treatment in pediatric chronic health conditions. *Pediatr Psychol*, 33(6), 590–611. <https://doi.org/10.1093/jpepsy/jsm128>.
- LaGreca, A. M., & Bearman, K. J. (2003). Adherence to pediatric treatment regimens. In M. C. Roberts (Ed.), *Handbook of pediatric psychology* (3rd ed., pp. 119–140). New York: Guilford Press.
- LaGreca, A. M., & Mackey, E. R. (2009). Type I diabetes mellitus. In Donahue & Woodward (Eds.), *Behavioral approaches to chronic illness in adolescents: An integrative approach* (pp. 85–100). New York: Springer. <https://doi.org/10.1007/978-0-387-87687-0>.
- Lemanek, K. L., Kamps, J., & Chung, N. B. (2001). Empirically supported treatments in pediatric psychology: Regimen adherence. *Journal of Pediatric Psychology*, 26(5), 253–275. <https://doi.org/10.1093/jpepsy/26.5.253>.
- Logan, D., et al. (2003). The illness management survey: Identifying adolescents' perceptions of barriers to adherence. *Journal of Pediatric Psychology*, 28(6), 383–392. <https://doi.org/10.1093/jpepsy/jsg028>.
- Lustman, P. J., & Clouse, R. E. (2005). Depression in diabetic patients: The relationship between mood and glycemic control. *Journal of Diabetes and its Complications*, 19(2), 113–122.
- McGrady, M. E., & Hommel, K. A. (2013). Medication adherence and health care utilization in pediatric chronic illness: A systematic review. *Pediatrics*, 132(4), 730–740. <https://doi.org/10.1542/peds.2013-1451>.

- Osterberg, L., & Blaschke, T. (2005). Adherence to medication. *The New England Journal of Medicine*, *353*, 487–497. <https://doi.org/10.1056/NEJMra050100>.
- Petrie, K. J., Perry, K., Broadbent, E., & Weinman, J. (2012). A text message programme designed to modify patients' illness and treatment beliefs improves self-reported adherence to asthma preventer medication. *British Journal of Health Psychology*, *17*, 74–84. <https://doi.org/10.1111/j.2044-8287.2011.02033.x>.
- Rianthavorn, P., Ettenger, R. B., Malekzadeh, M., Marik, J. L., & Struber, M. (2004). Noncompliance with immunosuppressive medications in pediatric and adolescent patients receiving solid-organ transplants. *Transplantation*, *77*, 778–782.
- Rohan, J. M. (2015). Predicting health resilience in pediatric type 1 diabetes: A test of the resilience model framework. *Journal of Pediatric Psychology*, *40*(9), 956–967. <https://doi.org/10.1093/jpepsy/jsv061>.
- Sabaté, E. (Ed.). (2003). *Adherence to long-term therapies: Evidence for action*. Geneva: World Health Organization.
- Sommerfield, A. J., Deary, I. J., & Frier, B. M. (2004). Acute hyperglycemia alters mood state and impairs cognitive performance in people with type 2 diabetes. *Diabetes Care*, *27*(10), 2335–2340. <https://doi.org/10.2337/diacare.27.10.2335>.
- Taddeo, D., Egedy, M., & Frappier, Y. J. (2008). Adherence to treatment in adolescents. *Paediatrics & Child Health*, *13*(1), 19–24.
- Warner, & Hauer. (2009). Unique considerations when using treating adolescents with chronic illness. In Donahue & Woodward (Eds.), *Behavioral approaches to chronic illness in adolescents: An integrative approach* (pp. 15–81). New York: Springer. <https://doi.org/10.1007/978-0-387-87687-0>.
- Whittemore, R., Jaser, S., & Jia, G. (2010). A conceptual model of childhood adaptation to type 1 diabetes. *Nursing Outlook*, *58*(5), 242–251.
- Wilson, et al. (2009). Shared treatment decision making improves adherence and outcomes in poorly controlled asthma. *American Journal of Respiratory and Critical Care Medicine*, *181*, 566. <https://doi.org/10.1164/rccm.200906-0907OC>.
- Wu, Y. P., & Hommel, K. A. (2014). Using technology to assess and promote adherence to medical regimens in pediatric chronic illness. *The Journal of Pediatrics*, *164*(4), 922–927.
- Wu, Y. P., & Roberts, M. C. (2008). A meta-analysis of interventions to increase adherence to medication regimens for pediatric otitis media and streptococcal pharyngitis. *Journal of Pediatric Psychology*, *33*(7), 789–796. <https://doi.org/10.1093/jpepsy/jsn009>.
- Wysocki, et al. (2008). Randomized, controlled trial of behavioral family systems therapy for diabetes: Maintenance and generalization of effects on parent-adolescent communication. *Behavior Therapy*, *39*(1), 33–46.