

# Chapter 4

## Interventions to Promote Adherence: Innovations in Behavior Change Strategies

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**Abstract** Only in recent years has a large enough body of research on adherence-promoting interventions been amassed so that systematic reviews and meta-analyses of their impact can reliably be evaluated. Overall, these reviews indicate that interventions tend to result in modest improvements in adherence to treatment recommendations and medications, with effect sizes typically in the small to medium range across various chronic condition populations and intervention types. Positive effects on health outcomes have also been reported. This chapter reviews the literature on interventions for pediatric nonadherence, paying special attention to recent innovations that have the potential to expand interventions' reach and effectiveness.

Children and youth identified as struggling with nonadherence often get referred for specialized treatment focused on improving adherence-related behaviors. According to Rapoff (2010), interventions fall under one of several categories:

- *Educational interventions* presume a knowledge deficit on the part of patient or parent and focus on improving knowledge and understanding of the disease, the disease process, and both the rationale and the mechanics of treatment. Educational interventions are often the first line of approach utilized by healthcare providers.
- *Organizational strategies* focus on making the medical regimen more manageable for families, and on making the healthcare system easier to navigate. Examples include simplifying medical regimens, providing organizational tools such as labeled pill boxes, recording logs, or using automated reminder systems.
- *Behavioral interventions* focus on changing specific behaviors, typically through use of positive reinforcement (or reward) for increasing desired behaviors, and to a lesser degree punishment for reducing the frequency of undesired behaviors. To be effective behavioral interventions typically require specialized training in behavioral health principles or clinical psychology.
- *Psychosocial interventions* are focused on the comorbidities that often accompany nonadherence (e.g., cognitive-behavioral therapy for depression). Psychoso-

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cial interventions do not specifically target adherence, but can be used in concert with explicitly adherence-oriented approaches.

Although there is variability in the format, content, length, and other details of adherence interventions, nearly all meta-analyses and reviews conclude that behavioral and multicomponent interventions tend to have the greatest impact on improving adherence, both for acute (Wu and Roberts 2008) and chronic medical conditions (Dean et al. 2010; Graves et al. 2010; Kahana et al. 2008; Lemanek et al. 2001; Salema et al. 2011) compared to other intervention strategies. That is, interventions were most successful when they included behavioral strategies such as goal-setting, problem-solving, behavioral contracting, contingencies/incentives, and developing behavioral routines, either alone or in combination with other components (e.g., psychological symptoms, health education).

There is some evidence that treating psychosocial factors within a behavioral intervention may boost its effectiveness. A meta-analysis of adherence promotion interventions for youth with type 1 diabetes found that those that have the largest impact on diabetes control tended to be multicomponent interventions that focused on adherence behaviors in combination with emotional, social, or family processes related to diabetes management (Hood et al. 2010). Clinical experience suggests that when patients present with more severe psychological difficulties such as major depression or bipolar disorder, the mental illness almost always needs to be treated first, before nonadherent behaviors can begin to be addressed.

Other beneficial components of interventions include: making interventions disease-specific (Wysocki et al. 2006); tailoring the content to youths' developmental level; including family members in the intervention; and making interventions more accessible by delivering them at home, in school, or via technology (Salema et al. 2011). Interventions focusing on education alone have been found least effective in changing adherence behavior.

Of note, the patterns that emerge for improving adherence largely translate to improvements in health outcomes as well (Graves et al. 2010; Pai and McGrady 2014). For group comparison studies, Graves et al. reported small but significant effects of adherence interventions on glycemic control in type 1 diabetes ( $d=0.28$ ) and BMI in obesity ( $d=0.10$ ), and large effects on pulmonary function in asthma ( $d=1.01$ ) and in overall healthcare utilization ( $d=1.41$ ). Moreover, these health benefits remained significant on subsequent follow-up. Moderate-to-large effects on health were found for single-subject designs ( $d=0.74$ ) that also persisted on follow-up ( $d=0.87$ ) (specific illness variables not reported). Taken together, these findings provide relatively strong support for the health benefits of adherence-focused interventions.

## Family-Focused Interventions

Historically, behavioral interventions delivered to youth with chronic conditions and to their families (e.g., a parent or the family unit as a whole) have been among the most successful in improving adherence behaviors. Given the documented importance of collaborative, age-appropriate family involvement in youths' disease

management and the risks associated with conflictual or uninvolved family relationships (Naar-King et al. 2013; Reed-Knight et al. 2011; Wysocki et al. 2008), the importance of intervening at the family level is unsurprising. Effective family interventions to improve adherence to a range of chronic condition treatment regimens include *family teamwork interventions* that teach disease-related problem-solving and family communication skills (Anderson et al. 1999; Duncan et al. 2013) and *family systems therapy* interventions that target maladaptive family interactions (Wysocki et al. 2006; Gray et al. 2011). Family-level interventions tend to be most effective when they are tailored to the specific chronic illness and the issues that arise around illness management.

## Recent Innovations in Adherence Interventions

**Electronic Monitoring Feedback** A major focus of recent intervention studies has been the integration of routine adherence monitoring with feedback about adherence patterns to the patient and family (Herzer et al. 2012). In this approach, electronic monitors including pill bottles, inhalers, glucometers, or other tracking devices are used to record patients' medication adherence, and the healthcare provider or interventionist reviews the objective adherence data with the patient. The goal of electronic monitoring feedback is to allow patients and families to examine their own adherence data to identify behavioral patterns, generate solutions, and observe their progress over time (Herzer et al. 2012).

Electronic monitoring feedback is increasingly included as one piece of larger multicomponent behavioral interventions targeting adherence (e.g., problem-solving, cognitive behavioral therapy, behavioral contracts and incentives). Evidence from clinical trials for the use of electronic monitoring feedback across pediatric populations is mounting, with the most support for improved adherence among youth with asthma (Burgess et al. 2010; Chan et al. 2013; Otsuki et al. 2009; Rohan et al. 2013). Improved adherence among youth with epilepsy (Modi et al. 2013) as well as case studies using this approach with patients with Fanconi Anemia (Hilliard et al. 2011), ulcerative colitis, spina bifida, cystic fibrosis, Crohn's disease (Cortina et al. 2013), end stage renal disease, post-kidney transplant, (Herzer et al. 2012), and asthma (Spaulding et al. 2012) further support this as a promising new intervention strategy.

**Motivational Interviewing (MI)** MI as a strategy for promoting adherence has also been an increasing focus of empirical investigation in recent years (Duff and Latchford 2010; Gayes and Steele 2014; Suarez and Mullins 2008). A communication style more than a manualized intervention, MI provides a way for healthcare providers to discuss potential health behavior changes with patients and families (Suarez and Mullins 2008). Using this approach, interventionists provide an opportunity for patients to consider how engaging in particular health behaviors (e.g., medication adherence) would or would not align with their personal goals. The ultimate aim of this communication style is for the patient to verbalize and act on

personal motivation to engage in the health behaviors. As MI approaches are highly patient-centered, it has been suggested that they may be particularly helpful during times when motivations and goals are conflicting and in flux, for example in adolescence or during the transition into adulthood (Powell et al. 2014).

Results of MI interventions to date have been mixed. A recent meta-analysis of MI interventions for pediatric adherence across a range of conditions found a small but significant overall effect size ( $g=0.28$ ) (Gayes and Steele 2014). Moreover, while direct improvements in adherence in response to MI are not always evident, other benefits such as increases in motivation and readiness to adhere to medications, improvements in health-related quality of life, and decreases in symptoms have been reported for adolescents with asthma (Riekert et al. 2011; Seid et al. 2012), diabetes (Channon et al. 2007), and HIV (Naar-King et al. 2010). The potential utility of MI to promote treatment adherence among youth with other conditions (e.g., cystic fibrosis, obesity) has been emphasized (Gayes and Steele 2014) and ongoing research in this area will continue to evaluate the impact on adherence to treatment recommendations (Bean et al. 2012; Flattum et al. 2009; MacDonnell et al. 2012).

Like electronic monitoring feedback, MI is often integrated into multicomponent interventions (Flattum et al. 2009; Seid et al. 2012). There is evidence that its incorporation may enhance treatment by improving patient participation and retention in intervention (Powell et al. 2014), an important issue given high rates of treatment attrition (Skelton and Beech 2011). For example, Bean et al. (2014) used a two session MI intervention with adolescents in a multidisciplinary treatment program for pediatric overweight/obesity. Participants remained in treatment longer and had better long-term follow-up. Thus, a primary value of MI approaches might be to help maximize the effectiveness of other evidence-based interventions.

## Provider-Based Intervention Delivery

There are many ways in which pediatricians and other healthcare providers can foster adherence in their patients. Providers assess patient and family knowledge and understanding of the disease and its treatment, and provide ongoing education as the disease course changes and children grow and develop. When possible, simplifying the treatment regimen can reduce barriers to adherence such as cost and treatment burden (Wolf et al. 2011).

In order for healthcare provider-based adherence promoting interventions to be effective, providers must be trained in the intervention skills and protocols. Thus, researchers have begun evaluating the outcomes of training providers to conduct basic behavioral interventions traditionally delivered by behavioral health specialists. For example, Rohan and colleagues (2013) conducted a pilot study of provider training in electronic monitoring feedback, in which they trained pediatric pulmonologists to routinely collect and discuss electronic adherence data from their

patients with asthma. The pulmonologists participated in a single training session plus individual supervision following patient visits for several months. Short-term improvements in children's adherence to preventive asthma medications were reported, compared to patients whose providers did not use this approach.

Researchers have also evaluated the impact of training pediatric healthcare providers in MI (Bean et al. 2012; Lozano et al. 2010). In both published examples of MI training, 6–9 hours of group MI training were conducted, including didactic teaching about the MI philosophy and specific skills, review and discussion of video vignettes, and in vivo role-play practice with feedback from the trainers. Lozano and colleagues (2010) also observed participants delivering MI, and provided feedback after 3 months of using MI in practice. In both studies, improvements were reported in providers' understanding of MI and in using MI skills in clinical encounters. Across both intervention types, the provider trainings were noted to be feasible and acceptable to clinicians.

Other interventions to teach providers effective communication skills and promote patient-centered care have been developed and investigated in pediatric and adult healthcare settings (Nobile and Drotar 2003; Zolnierek and DiMatteo 2009). These interventions tend to result in improvements in the patient-provider relationship, and in observer ratings of provider communication skills and patient-centeredness (e.g., demonstrating empathy, asking questions, encouraging the patient/family to participate in medical decision-making). To a lesser degree, some benefits have been reported in terms of adherence behaviors or health outcomes; however, such studies with pediatric health care providers have been limited (Birk et al. 2005; Dwamena et al. 2012; Nobile and Drotar 2003).

Studies suggest that there is a pressing need for these types of interventions. Youth with chronic conditions often report that they have difficulty receiving understandable answers to health questions and that they feel under-involved in medical decisions (Byczkowski et al. 2010; Van Staa 2011), factors that can influence their participation in medical self-care. Extending communication skills training to pediatric providers may help address this concern. Communication skills training may also be especially important for working with families from racial/ethnic or socioeconomic minority backgrounds, who frequently report dissatisfaction with provider communication and rapport-building, as we discuss in more detail in Chap. 9.

Taken together, these results suggest a promising future for disseminating both electronic monitoring feedback and MI into clinical research and practice for pediatric adherence intervention via well-trained healthcare providers. However, these relatively brief trainings are often insufficient for providers to reach competence in the approach (e.g., Bean et al. 2012), and there are no data to date on long-term effects or direct effects on patient outcomes. These approaches may therefore be most suitable as “universal-level” interventions (Kazak 2006) focused on improving the healthcare provided to all patients, but they are unlikely to be very effective for many patients and families at higher risk, who are at higher risk and face more barriers with adherence and illness control.

## Technology, eHealth, and mHealth

The use of technology in adherence intervention research is an area of rapid growth. Technology-based interventions include delivery of strategies to promote adherence via the internet (eHealth) or electronic mobile devices such as with text messaging or smartphone applications (mHealth). Noted benefits of using technology to deliver adherence promotion interventions include reaching youth through a medium with which they are familiar and already engaged, potential for individualization, and the ability to assess adherence as well as intervene (Wu and Hommel 2014).<sup>1</sup>

Evidence for technology-based interventions is building, with encouraging findings for using the internet or mobile devices to deliver behaviorally-based interventions to promote treatment adherence for youth with various chronic conditions (Cushing and Steele 2010; Herbert et al. 2013; Stinson et al. 2009; Wu and Hommel 2014). Like their in-person counterparts, technology-based adherence interventions that emphasize behavioral components have more consistent beneficial effects on adherence outcomes (Cushing and Steele 2010). In addition, recommendations include integrating the technology with a human interaction, such as using eHealth to supplement in-person intervention, or including a face-to-face meetings with a health coach at the start of a mobile intervention, as the supportiveness and accountability of human contact can help increase participants' motivation and engagement with the technology (Mohr et al. 2011).

In the past five years, technology interventions have been shown to result in improvement in adherence to medical treatments for many pediatric chronic conditions, including type 1 diabetes (Herbert et al. 2013; Mulvaney et al. 2010), asthma (Gustafson et al. 2014; Searing and Bender 2012), HIV (Dowshen et al. 2012; Naar-King et al. 2013; Shegog et al. 2012), cystic fibrosis (Marciel et al. 2010), cancer (Kato et al. 2008), sickle cell disease (Creary et al. 2014), post-liver transplant (Miloh et al. 2009), and systemic lupus erythematosus (Ting et al. 2012). Medication or treatment reminders via text message are among the most common types of technology interventions (Cole-Lewis and Kershaw 2010). Although the use of technology does not necessarily equate to improvements in adherence, it may increase the accessibility and reach of adherence promotion interventions and thus holds the potential to increase the likelihood of adherence behaviors occurring in their natural or recommended times and places.

## Targeting Interventions to the Highest Risk Patients

Patients at the highest risk for disparities in adherence and health outcomes tend to be poor and to come from racial and ethnic minority backgrounds (see Chap. 8 and 9). They also account for a very large proportion of all health expenditures, largely

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<sup>1</sup> Although the electronic monitoring feedback interventions described above by definition use technological tools to monitor adherence, the feedback portion is typically delivered in person and thus is distinct from the interventions discussed in this section.

through expensive hospitalizations for illness crises. Many of these hospitalizations result from nonadherence and therefore may be preventable to some degree (Schwartz et al. 2010). With the changing economic climate impacting healthcare, the need to reduce healthcare costs is ever more evident. To begin to address this issue, adherence promotion interventions have been developed that focus on improving health, and thus reducing healthcare costs, among the patients at highest risk for poor health outcomes. Targeting resources to the patients in greatest need is also necessitated by the relative paucity of available services (Kazak 2006).

In order to deliver care to the patients in greatest need of adherence promotion intervention, patients may be identified in a number of ways, including physical signs of poor illness control, multiple hospitalizations for disease complications, significant psychosocial distress, or behavioral measures of non-adherence. Among youth with epilepsy, Modi et al. (2013) used electronic adherence monitoring to assess patients' average weekly adherence rates, and triaged patients to different levels of adherence intervention accordingly. Similarly, Gamble et al. (2011) identified patients with low adherence via pharmacy refill records prior to being enrolled in an adherence promotion intervention. Many of these interventions emphasize preventive intervention early in the disease course, which is likely to be an important component of adherence promotion.

Once patients are identified as being in need of intervention, evidence-based treatments have been adapted to target adherence behaviors for specific diseases. For example, Behavioral Family Systems Therapy is a well-validated, multicomponent intervention that has been tailored for the unique issues and challenges of managing type 1 diabetes, particularly among youth with glycemic control well outside the recommended range (Wysocki et al. 2008).

**Multisystemic Interventions** Many of the patients at highest risk have multiple comorbid risk factors that may span individual, family, and socioeconomic levels. A number of recent interventions focus on a more multilevel approach to care, often using a home- and community-based approach. Multisystemic therapy (MST) is an evidence-based treatment approach for youth at high risk that addresses individual and family factors within the broader contexts (e.g., school, healthcare system) in which they exist. MST interventions have resulted in significant improvements in adherence and health outcomes for youth with type 1 diabetes who have chronically poor metabolic control (Ellis et al. 2005) and for poorly adherent youth with HIV (Ellis et al. 2006; Letorneau et al. 2013).

Multisystemic interventions are highly promising and likely necessary to advance the effectiveness of adherence interventions, given the multifactorial nature of many adherence difficulties. However, they tend to be resource-intensive and may not always be feasible to implement on a wide scale. An important area for future clinical research is to demonstrate that these interventions can be cost-effective. In important recent work, Harris and colleagues (2013) have demonstrated the feasibility and economic benefits of intensive individualized intervention implemented in clinical practice for the costliest, highest risk youth with a range of chronic conditions. The *Novel Interventions in Children's Healthcare* (NICH) program pro-



vides intensive in-home interventions for youth who are repeatedly hospitalized for preventable health problems, with the goal of improving adherence by addressing barriers to care in all parts of the child's environment. NICH interventionists provide care coordination, case management, and family-based problem-solving therapy, maintaining close contact with the family and acting as a liaison between the youth, the family, healthcare providers, community agencies and schools. Preliminary data show that the program results in substantial reduction of hospitalizations and healthcare costs (Harris et al., 2014).

## Summary and Conclusions: Adherence Promotion in Clinical Practice

After several decades of research, we have a good understanding of what works to treat nonadherence, and why. Effective interventions tend to use behavioral strategies, incorporate some patient education, address comorbidities, and involve the family in care. They also may focus on improving provider communication with patients, (see Chap. 9).

In a recent editorial introducing a special issue on adherence in the *Journal of Pediatric Psychology*, Stark (2013) offered a number of additional conclusions. First, she suggested that recent studies indicate that treatment benefits do not appear to outlast the duration of intervention, suggesting the need for boosters or other ongoing processes to foster adherence and detect nonadherence in the longer term. Second, she highlighted that patients in real-world settings differ from carefully selected study participants in that they are characterized by co-morbidities and complexities that are winnowed out in well-controlled research. Thus, providers should be wary of generalizing study findings to clinical settings; and indeed, empirically-supported treatments are only one part of evidence-based practice, along with patient/family preferences, and clinical expertise (Spring 2008). However, the recent move toward multi-component interventions and intervention studies conducted in the field (e.g., Harris et al. 2013) is likely to build the evidence base for empirically-supported interventions for more children and families.

Table 4.1 summarizes the mean effect sizes for different adherence interventions as reported in various recent meta-analyses. Effects range from small to large depending on intervention type, sample characteristics, and study design (single-subject versus group), although overall the effects seem to fall primarily in the small to medium range. As noted above, medium effects can be clinically meaningful, as evidenced by the improvements in health outcomes noted by Graves et al. The large effects found for single-subject designs are also encouraging, as these studies may better reflect the actualities of everyday clinical practice. However, it should be noted that the large reported effects might reflect publication bias (Graves et al. 2010).



**Table 4.1** Mean effect sizes reported in adherence intervention meta-analyses

Intervention	<i>M</i> effect size	Categorization	Reference
Overall	0.20–0.29 0.34 0.58 1.53*	Small Small Medium Large	Pai and McGrady 2014 Kahana et al. 2008 Graves et al. 2010
Behavioral	0.54 0.11	Medium Small	Kahana et al. 2008 Wu and Roberts 2008
Multi-component	0.51 0.60–1.33	Medium Medium-Large	Kahana et al. 2008 Wu and Roberts 2008
Educational	0.16 –0.42†	Small Medium	Kahana et al. 2008 Wu and Roberts 2008

Note: Effect size categorization: 0.20=small; 0.50=medium; 0.80=large (Cohen 1992)

\*Single-subject designs. All other effect sizes are for group studies

† Negative effect size indicates outcomes were better in control group than intervention group

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