The Society for Clinical Child and Adolescent Psychology (SCCAP): Initiative for Dissemination of Evidence-based Treatments for Childhood and Adolescent Mental Health Problems

With additional support from Florida International University and The Children's Trust.

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Keynote

Evidence Based Interventions for Pediatric Medical Treatment Adherence

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Disclosures

Dr. Rapoff is on the scientific advisory board of Adheris, a company that works with pharmacy chains to promote adherence to medications.

"Physicians like to succeed in their treatment, and an essential ingredient for that success is a patient's cooperation"

Groopman, J. (2007). *How doctors think* (p. 45). Boston: Houghton Mifflin

Learning Objectives

1. Define adherence and types of nonadherence
2. Describe methods for assessing adherence
3. Document the incidence and consequences of nonadherence to pediatric medical regimens
4. Describe measures of barriers to adherence and their use in interventions
5. Describe adherence enhancement strategies
6. Review meta-analyses of interventions to improve adherence to pediatric medical regimens

Adherence Definitions

"The extent to which a person's behavior (in terms of taking medications, following diets, or executing lifestyle changes) coincides with medical or health advice."

Haynes et al. (1979). *Compliance in health care*. Baltimore: The Johns Hopkins University Press.

"The extent to which a person's behaviour – taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider."

World Health Organization (2003). *Adherence to long-term therapies: Evidence for action*. Geneva, Switzerland.

Types of Medication Nonadherence

Types of Medication Nonadherence

- Not filling prescription
- Not (or delays in) refilling prescription
- Omitting doses
- Drug holidays (no doses for several concurrent days)
- “Toothbrush Effect” or “White-coat” Adherence (increased adherence around clinic visits)
- Overdosing or taking extra “make-up” doses

Adherence Measures

- Assays
- Observation
- Automated Devices
- Pill Counts
- Treatment Outcome
- Provider Estimates
- Patient Report

- Rapoff, 2010

Assays

- Assets
  - Adjust Drug Levels
  - Objective and Quantifiable
- Liabilities
  - Pharmacokinetics may affect absorption and excretion rates
  - Short-term & Invasive

Observation

- Assets
  - Direct measure of non-medication regimen adherence
  - Can measure adherence on repeated occasions
- Liabilities
  - Obtrusive and reactive
  - Difficult to obtain representative samples

Automated Measures

- Assets
  - Precise dosing and dosing interval data obtained
  - Continuous and long-term measurement possible
- Liabilities
  - Does not measure consumption
  - Mechanical failures

Medication Event Monitoring System (MEMS)

MEMS

- Records date and time cap removed
- 18-month battery life
- Stores up to 3800 events
- Software to download data
- Cost is ~ $185 per device
- http://www.aardexgroup.com

Event List

Date	Time hh:mm	Interval dd:hh:mm	Multiple Open/Close	Notes
05/13/96	14:46			Clinic Visit
	19:46			
05/14/96	06:43	00:10:57		
	19:10	00:12:27		
	20:57			Prescription Refill
	20:57	00:01:47		
05/15/96	06:37	00:09:40		
	19:15	00:12:38		
05/16/96	06:40	00:11:25		
	19:39	00:12:59		
05/17/96	06:30	00:10:51		
	20:18	00:13:48		
05/18/96	06:28	00:10:10		
	17:18	00:10:50		
05/19/96	06:13	00:12:55		
	16:40	00:10:27		
05/20/96	06:07	00:13:27		
	06:10			Filtered
05/21/96	06:57	01:00:50		
05/22/96	06:33	00:23:36		
05/23/96	06:20	00:23:47		
05/24/96	07:16	01:00:56	01	
05/25/96	06:39	00:23:23		
05/26/96	08:17	01:01:38		
	19:34	00:11:17		

SmartTrack

Compatible Medications:

GSK Advair/Seretide Dose Counter

GSK Flovent Dose Counter

GSK Flixotide No Dose Counter

GSK Serevent

Sepracor Xopenex HFA

Smartinhalers

- Record inhaler installed and removed and canister actuation, date and time stamped
- 2-3 month between charges
- Reusable
- Have devices for disk and turbo inhalers
- Cost is $195 per device
- Software available to download data
- Nexus6: http://www.smartinhaler.com/

Pill Counts/Canister Weights

- Assets
  - Inexpensive & Feasible
  - Superior to patient or physician estimates
- Liabilities
  - Overestimates adherence
  - Does not guarantee medication taken

Treatment Outcome

- Assets
  - Evaluate regimen efficacy
  - Clinically feasible
- Liabilities
  - Inexact or unknown relationship to adherence
  - Factors other than patient adherence can affect outcome

Physician Estimates

- Assets
  - Clinically feasible
  - Generally more accurate than global patient estimates
- Liabilities
  - Overestimates adherence
  - Physician experience or familiarity with patient unrelated to accuracy

Patient Report

- Assets
  - Clinically feasible
  - Generally accurate for nonadherence
- Liabilities
  - Overestimates adherence
  - Subject to reporting bias – “faking good”

Improving Self-Reported Adherence

- Directly evaluate adherence behaviors in an information-intensive approach (“Which medications are you taking? What dose? How often? Have you had any side-effects?”).
- Probe for nonadherence in a non-judgmental and non-threatening manner (“Many people have trouble remembering to take their medication. Do you ever forget to take yours? Do you ever stop taking your medication on purpose?”)

Improving Self-Reported Adherence

- Time frame for questioning about adherence should be limited to the previous 7 to 10 days.
- Ask families about barriers to adherence (personal, financial, social & cultural).

Rand (2000)

RX-Adherence Assessment

“AA” Rating = Automated plus Assay measure

Adherence to Inhaled Steroids in the treatment of Asthma

- M = 69% (65% classified as nonadherent, <80%) by electronic monitoring (Berg et al., 2007)
- M = 44% by canister weight (Celano et al., 1998)
- Underuse recorded on M = 55% of days by electronic monitoring (Coutts et al., 1992)
- M = 48% by electronic monitoring (McQuaid et al., 2003)
- M = 51% by electronic monitoring (McQuaid et al., 2005)
- M = 46% by electronic monitoring (Walders et al., 2005)
- M = 77% @ 3-month f/u to M = 49% @ 27-month f/u by dose counting (Jónasson et al., 2000)

Adherence to Prednisone in the treatment of Cancer

- 52% had subtherapeutic levels by serum assay (Festa et al., 1992)
- 42% had subtherapeutic levels by urine assay (Lansky et al., 1983)
- 33% had subtherapeutic levels by urine assay (Smith et al., 1979)
- 19% nonadherent (any missed dose in preceding month) @ 2-weeks, 40% @ 20-weeks, & 35% @ 50-weeks by patient and parent report (corroborated by serum assay) (Tebbi et al., 1986)

Adherence to Gluten-free Diet for Celiac Disease

- 28% classified as nonadherent by pediatric gastroenterologist (Anson et al., 1990)
- 46% classified as “occasional nonadherence” and 15% as “frequent nonadherence” by dietician interview (Bazzigaluppi et al., 2006)
- 40% had “poor adherence” by serum anti-bodies and clinical exam (Demir et al., 2005)
- 17% nonadherent by serum nitric oxide levels @ 1-yr f/u (Ertekin et al., 2005)
- 54% had “occasional lapses” by “clinical evaluation” (patient and parent interview plus serum anti-bodies) (Hartman et al., 2004)
- 29% nonadherent by serum anti-bodies (Kolaček et al., 2004)

Adherence to Antiretroviral Medications in the treatment of HIV/AIDS

- 44% of caregiver-youth dyads reported missing doses in the past week (Dolezal et al., 2003)
- M = 80.9% adherence rate **during 1st 3 months & M = 78.5% during last 3 months** by electronic monitoring (Martin et al., 2007)
- 40% of caregivers & 56% of patients reported missed doses in the past month (Mellins et al., 2004)
- 43% of caregivers reported a missed dose in the previous week (Reddington et al., 2000)
- 30% of caregivers or patients reported missing some or all doses in the past 3 days (Van Dyke et al., 2002)
- 16% of caregivers or patients reported missing some doses in the past 3 days (Williams et al., 2006)

Adherence to NSAIDS in the treatment of JRA

- Baseline M = 86%; 3-mos f/u M = 92%; 6-mos f/u M = 90%; 9-mos f/u M = 92%; 12-mos f/u M = 89% by parent report over past 3 months (Feldman et al., 2007)
- 3% nonadherent (<60% of doses) by pill counts (Giannini et al., 1990)
- M = 95% by pill counts (Kvien & Reimers, 1983)
- 45% nonadherent by serum salicylate assay (Litt & Cuskey, 1981)
- 45% nonadherent by serum salicylate assay (Litt et al., 1982)
- Median levels showed partial or no adherence on 21% of 28 days; 48% nonadherent(<80% of doses) by electronic monitoring (Rapoff et al., 2005)

Adherence to Immunosuppresive Medications Post-renal Transplantation

- 43% nonadherent by pill counts (Beck et al., 1980)
- 21% nonadherent (<80% doses) by electronic monitoring (Blowey et al., 1997)
- 50% nonadherent by patient report plus serum assay (Ettenger et al., 1991)
- 16% nonadherent by patient report plus serum assay (Feinstein et al., 2005)
- M = 80% by electronic monitoring (Gerson et al., 2004)
- 14% nonadherent (missing medication ≥ 3 times a month) by patient report (Penkower et al., 2003)

Consequences of Nonadherence

- Physicians unaware of nonadherence may order more invasive, risky, and costly procedures and may prescribe more potent meds with greater side-effects (Rapoff, 2010).
- More days with functional limitations and school absences; increased ER visits and hospitalizations; & increase in asthma-related deaths (Rapoff, 2010).
- 71% of nonadherent patients experienced rejection & had partial or total loss of allograft function (Ettenger et al., 1991).
- Nonadherence associated with higher viral loads in HIV/AIDS (Martin et al., 2007; Reddington et al., 2000).
- Cost of nonadherence in U.S. estimated at $100 billion per year (Berg et al., 1993).

Barriers to Adherence

- Barriers defined: “the person’s perception of impediments to adhere to treatments, including a cost-benefit analysis where the person weighs the pros and cons of taking action” (Rapoff, 2010).
- Most predictive variable from the Health Belief Model.
- Match unique barriers identified by patients and families to specific protocols to address each barrier.

Measures of Barriers to Adherence

- Parents Barriers Questionnaire-Juvenile Arthritis (JA) (Tsai, Matson, Rapoff, & Lindsley)
- Define barriers as “obstacles or things that get in the way of you helping your child be consistent in following medical treatments for arthritis.”
- Parents check “yes” for each barrier experienced in the past week or “no” if it not experienced.

Parents Barriers Questionnaire – Juvenile Arthritis (sample items)

- “I just forget when to give my child medications.”
- “It is too hard to give my child medications when we are not at home.”
- “The pills are too hard for my child to swallow.”
- “My child simply refuses to take the medications.”
- “I am not sure that my child needs medication.”
- “I did not fill or refill my child’s prescription because I could not afford them.”

Top Five Barriers identified by parents of children with JA

- “My child says that the medication tastes bad.”
- “I just forget to give my child the medications.”
- “The pills are too hard for my child to swallow.”
- “I am not always there to remind my child to take medications.”
- “My child feels physically worse when he/she takes the pills."

Top Five Barriers identified by parents of children with a chronic disease (Michele Tsai, in progress)

- Patient or parent forgets
- Patient dislikes medication taste
- Oppositional behavior
- Treatment interferes with daily activities
- Difficulty incorporating treatment regimen into daily life

Burgess et al., (2008); De Civita et al., (2005); Greenley et al., (2010); Hommel & Baldassano (2010); Ingerski et al., (2010); Modi & Quittner (2006); Modi et al., (2009); Modi et al., (2010); Simons & Blount (2007)

Top Five Barriers identified by young people with a chronic disease (Michele Tsai, in progress)

- Patient or parent forgets (overlap with parents)
- Treatment interferes with daily activities (overlap with parents)
- Psychosocial adjustment difficulties
- Disagreement or communication problems with health care provider
- Regimen too complex

April et al., (2006); Dziuban et al., (2010); Greenley et al., (2010); Logan et al., (2003); Modi & Quittner (2006); Rhee et al., (2009); Modi et al., (2009); Simons & Blount (2007); Zelikovsky et al., (2008).

Adherence Enhancement Strategies

- Educational (about disease, treatments, and importance of adherence)
- Organizational (delivering health care in a way that facilitates adherence)
- Behavioral (cognitive and behavior change strategies to enhance adherence)

The What of Education (Content)

- The Disease (causes, course & prognosis)
- Treatments (what to do and why)
- Negative Side Effects (how to minimize)
- Adherence (importance and improvement strategies)

The How of Education (Strategies)

- As an ongoing process
- Effective verbal communication (avoid jargon, stress instructions, repeat info., encourage questions)
- Written & other media
- Modeling and behavioral rehearsal

Organizational Strategies

- Increase access to health care
- Consumer-friendly clinical settings
- Increase provider supervision
- Simplify regimens
- Minimize negative side effects

Behavioral Strategies

- Increased parental monitoring & supervision
- Prompting adherence
- Adherence incentives
- Discipline strategies
- Contracting
- Self-management strategies (goal setting, self-monitoring, self-administered consequences, problem-solving, & cognitive reframing)
- More complex family behavior therapy interventions

Meta-Analyses of Adherence Interventions

- Quantitative syntheses of studies reporting on interventions to improve adherence to regimens for chronic pediatric diseases.
- Report effect sizes (ES), the magnitude of treatment effects as measured by:

d, the difference between the means ($M_1 - M_2$) divided by the pooled standard deviation. Let $M_{1\ =}$ experimental group mean and M_2 = the control group mean, so that the difference is positive if it is in the direction of improved adherence (predicted direction). (Cohen, 1988)

d, for single subject designs uses baseline and treatment mean scores and they are subtracted and divided by the pooled within-phase standard deviations

Effect Size Interpretations

If *d* = 0.0, the distribution of scores for the experimental group overlaps completely with the distribution of scores for the control group. Cohen (1988) classified *d* as:

"Small", *d* = 0.2	(14.7% nonoverlap)
"Medium", *d* = 0.5	(33% nonoverlap)
"Large", *d* = 0.8	(47.4% nonoverlap)

http://web.uccs.edu/lbecker/Psy590/es.htm (information about effect size and effect-size calculators-University of Colorado at Colorado Springs)

Effects Size Examples: r = .10 [small]; .30 [medium]; .50 [large]

- Low dose aspirin & ↓ risk of heart attack
  = .02 (N = 22,071; 44% reduction in risk)
- Antihypertensives & ↓ risk of stroke
  = .03
- Calcium intake & bone mass in premenopausal women
  = .08
- Ever smoking and subsequent incidence of lung cancer within 25 yrs.
  = .08
- Prominent movie critic reviews & box office success
  = .17
- Psychotherapy & well being
  = .32
- Viagra & improved male sexual functioning
  = .38

Meyer et al., 2001

Meta-Analysis I (Kahana, Drotar, & Frazier, 2008)

- N = 70 adherence-promotion studies identified by literature search (using multiple search terms, such as *intervention, treatment, adherence, compliance* and various chronic conditions)
- # studies by condition: 32 (45.7%)-asthma; 16 (22.9%)-diabetes; 10 (14.3%)-CF; 2 each with JRA & obesity (2.9%, respectively); & one each for hemodialysis, hemophilia, HIV, IBD, PKU, seizure disorders, sickle cell disease, and TB (1.4% each)
- Of the 70 studies, 29 (41.4%) were identified as RCT; 42 (60%) reported effect size based on an experimental vs. control group design, while 19 (27.1%) reported effect size based on pre-post differences and another 9 (12.9%) reported both.

Meta-Analysis I: Demographics

- Mean age ranged from 2 to 15 yrs. (M = 10.2, SD = 3.2)
- Gender prevalence (based on 53 studies): 53.3% males vs. 47.4% females
- Ethnicity prevalence (based on 26 studies): 82% Caucasians
- Only 15 studies reported on SES; data could not be aggregated because they were based on very different indices of SES

Meta-Analysis I: Intervention Type and Format

- 34 (48.6%) - multicomponent
- 18 (25.7%) - educational
- 7 (10%) - behavioral
- 7 (10%) - technology based
- 4 (5.7%) - psychosocial
- 63 studies reported format
  - 52.4% were groups
  - 39.7% were individual based
  - the remainder included both group & individual components

Meta-Analysis I: Adherence Measures

- 67 studies reported information on ratings of adherence:
  - Parents (n = 26; 38.8%)
  - Children/Adolescents (n = 17; 25.4%)
  - Both parents and youth (n = 11; 16.4%)
  - Ratings by psychologists or medical personnel (n = 4; 6%)
  - Electronic monitor (n = 2; 3%)
  - Blood or urine assay (n = 3; 4.5%)
  - Teacher or “outsider” ratings (n = 2; 3%)
  - Pharmacy records and parent (n = 1; 1.5%)
  - Electronic monitor and child report (n = 1; 1.5%)

Parent or patient reports or combination of the two (n = 54; 81%)

Meta-Analysis I: Results

Weighted (by sample size) mean *d* across all adherence outcomes was in the “small” range:

d = .34 (95% confidence interval (CI) = 0.30 – 0.38)

However, there was significant heterogeneity across adherence outcomes. Therefore, the authors examined potential moderators of *d*.

Meta-Analysis I: Moderators of Adherence Outcome *d*

Types of Interventions

- Behavioral: *d* = .54 (medium), 95% CI = 0.34-0.73
- Multicomponent: *d* = .51 (medium), 95% CI = 0.45-0.57
- Psychosocial: *d* = .44 (small to medium), 95% CI = 0.23-0.65
- Educational: *d* = .16 (small), 95% CI = 0.10-0.22
- Technology based: *d* = .08 (NS), 95% CI = –0.09-0.25

Meta-Analysis I: Moderators of Adherence Outcome *d*

- Type of Adherence Outcome: self-management, self-care behaviors, dietary change, and exercise-environmental changes yielded medium *d*s, while medication adherence yielded small *d*s
- Type of Disorder: CF (medium to large), miscellaneous disorders (medium), diabetes (small to medium), & asthma (small)
- Type of Design: combined pre-post & experimental vs. control group (medium to large), pre-post only (small to medium), & experimental vs. control only (small)
- Follow-up: *d* diminished over time (0-6 mos. f/u, *d* = .63, 95% CI = 0.46-0.80; 7-12 mos. f/u, *d* = .24, 95% CI = 0.06-0.42; >12 mos. f/u, *d* = .50, 95% CI = -1.15-0.15)

Meta-Analysis II (Graves et al., 2010)

- N = 71 studies identified from literature search with terms *adherence* or *compliance* and paired with *treatment*, *strategies*, *improve*, *interventions*, education, medication, *child*, *adolescent*, and *pediatric*.
- Did not include obesity or lifestyle changes, just chronic illnesses.
- 34 (48.6%) used a comparison group design (experimental vs. control), 17 (24.3%) used a within subject design (pre-post), and 19 (28.2%) used a single-subject design.

Meta-Analysis II: Chronic Diseases

- Of group designs (N 51) with N =3027 patients (M=35.6):
- 16 (31.4%) asthma
- 15 (29.4%) type 1 diabetes
- 5 (9.8%) CF
- 3 each (5.9%) with HIV/AIDS or post-transplant
- 2 each (3.9%) with hyperlipidemia, JIA, & sickle cell
- 1 each (2%) with epilepsy, hemophilia, & PKU

Meta-Analysis II: Chronic Diseases

- Single subject design studies (N=20), with N=50 patients (M=2.6)
- 7 (36.8%) type 1 diabetes
- 3 (15.8%) each JIA & CF
- 2 (10.5%) asthma
- 1 (5.3%) each epilepsy, lung disease, rheumatic diseases, & sickle cell

Meta-Analysis II: Adherence Measures

- Group design studies:
  - Child report (N=14)
  - Parent report (N=9
  - Diary (N=9)
  - 24-h recall (N=8)
  - Electronic monitoring (N=10)
  - Pill count (N=7)
  - Blood or urine assay (N=6)
- Single subject design studies:
  - Diary (N=23, 71.9%)
  - Electronic monitoring (N=4, 12.5%)
  - Pill Count (N=3, 9.4%)
  - 24-hr recall (N=2, 6.3%)

Meta-Analysis II: Demographics

- Group design studies:
  - Age 2 to 15 yrs. (M = 9.9)
  - % males = 24% to 91% (M = 51.7%)
  - Minorities = 0% to 100% (M = 39.1%)
- Single subject design studies:
  - Age 2 to 17 yrs. (M = 11)
  - % males = 0% to 100% (M = 47.1%)
  - Minorities = 0% in 2 studies & 100% in 2 studies

Meta-Analysis II: Intervention Types

- For Group Design Studies:
  - Combined educational and behavioral (n=24, 47%)
  - Organizational (n=6, 11.8%)
  - Behavioral (n=5, 9.8%)
  - Educational (n=2, 3.9%)
  - Variety of combinations (n=13, 25.4%)
- For Single Subject Design Studies:
  - Educational and behavioral (n=9, 47.4%)
  - Behavioral (n=9, 47.4%)
  - Behavioral and organizational (n=1, 5.3%)

Meta-Analysis II: Adherence Outcomes

- Mean effect size (weighted by sample size) for group designs: *d* = 0.58 (“medium” range), 95% CI = 0.51-0.65
- Moderators of effect size: Higher effect size for studies using a wait-list control design (mean *d* = 1.09) vs. an alternative treatment design (mean *d* = 0.43)
- Mean effect size (weighted by sample size) for single-subject designs: *d* = 1.53 (“large” range), 95% CI – 1.07-1.98). No moderators of effect size as homogeneous.

Meta-Analysis II: Health Outcomes

- 31 studies reported health outcomes: direct (e.g., A1C) indirect (disease activity), healthcare utilization, or subjective (quality of life = QOL).
- Mean *d* = .40 (small to medium),

  95% CI = 0.31 – 0.50
- *d* higher for A1C, PFT, disease activity, & healthcare utilization vs. BMI & QOL

Research Implications from Meta-Analyses

1. Less reliance on indirect measures of adherence (parent & patient reports)
2. Need for larger, RCTs with attention-placebo and long-term follow-up
3. Include health outcomes (direct, indirect, health care utilization & costs, and QOL)
4. Explore moderators of effect sizes
5. Dismantling studies of multicomponent interventions
6. Recruit more ethnically diverse samples
7. Assess treatment fidelity and integrity (i.e., did patients/families receive intervention as intended & use the skills/knowledge imparted?)
8. Develop & test technology-based interventions

Clinical Implications for Enhancing Adherence

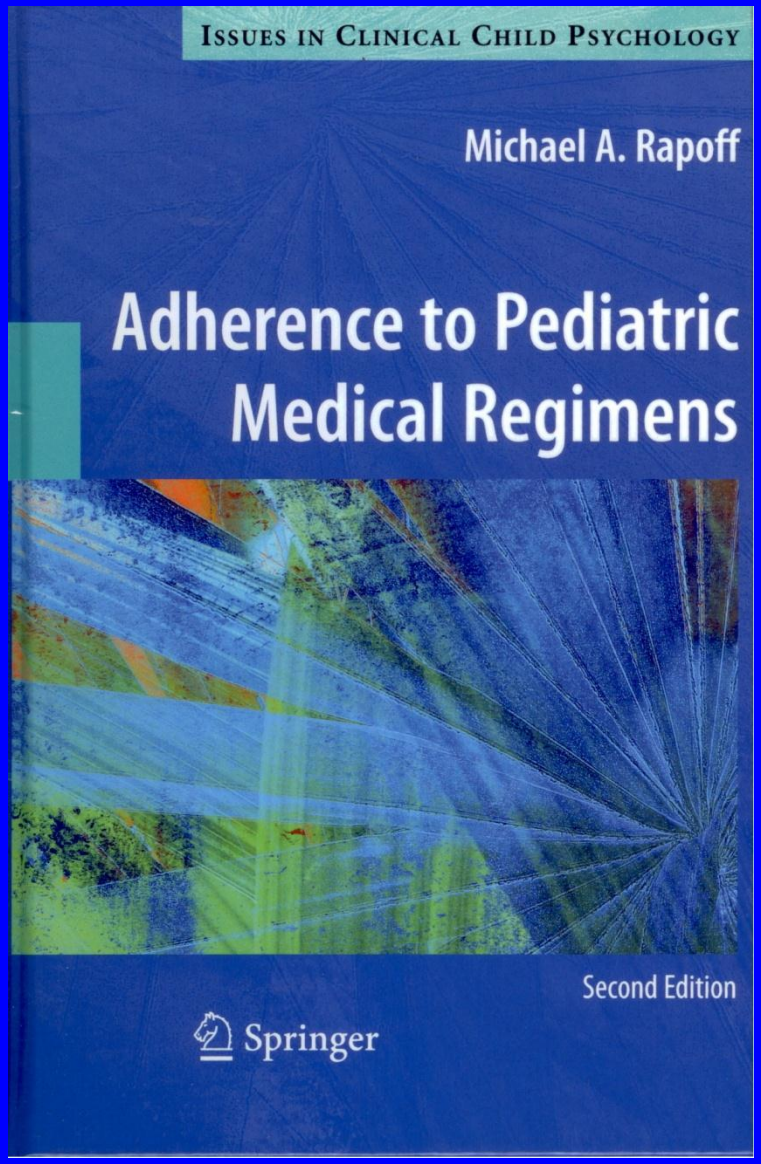
1. Educate and re-educate about disease, purpose of regimen, and need for consistent adherence
2. Secure patient/family agreement to follow regimen
3. Parent involvement key component (monitoring, supervising, & positive reinforcement)
4. Provide incentives to patients
5. Self-management skills for adolescents
6. One-shot bolus of an adherence intervention will not have lasting effects: interventions need to be part of ongoing clinical management of pediatric chronic diseases

When Is Nonadherence Medical Neglect?

- N = 6 patients perinatally HIV-infected children whose therapy was failing based on HIV RNA levels
- 3-Step approach taken:

  1. Home health care nurse visits 2 times per week for at least 2 wks
  2. Directly observed therapy (DOT) while patient was hospitalized for 4 days
  3. Physician-initiated medical neglect report to the Arkansas Department of Human Services
- Results: for 2 of 6 patients, a medical neglect report was necessary and resulted in foster care placement with improvements in viral load

Roberts et al. (2004)


Issues in Clinical Child Psychology
Michael A. Rapoff
Adherence to Pediatric Medical Regimens
Second Edition
Springer

For more information, please go to the main website and browse for workshops on this topic or check out our additional resources.

Additional Resources

Online resources:

1. Society of Clinical Child & Adolescent Psychology: https://clinicalchildpsychology.org
2. Society of Pediatric Psychology Adherence to Pediatric Medical Regimens Fact Sheet: http://www.apadivisions.org/division-54/evidence-based/medical-regimens.aspx

Books:

1. Rapoff, M.A. (2010). *Adherence to pediatric medical regimens*, (2nd ed.). New York: Springer.

Peer-reviewed Journal Articles:

1. Berg, J. S., Dischler, J., Wagner, D. J., Raia, J., & Palmer-Shevlin, N. (1993). Medication compliance: A health care problem. The *Annals of Pharmacotherapy, 27* (suppl.), 2-21.
2. Berg, C.J., Rapoff, M.A., Snyder, C.R., & Belmont, J.M. (2007). The relationship of children's hope to pediatric asthma treatment adherence. *The Journal of Positive Psychology, 2*, 176-184.
3. Burgess, S. W., Sly, P. D., Morawska, A., & Devadason, S. G. (2008). Assessing adherence and factors associated with adherence in young children with asthma. *Respirology, 13,* 559-563.
4. McQuaid, E.L., Walders, N., Kopel, S.J., Fritz, G.K., & Klinnert, M.D. (2005). Pediatric asthma management in the family context: The family asthma management system scale. *Journal of Pediatric Psychology, 30*, 492-502.
5. Modi, A. C., & Quittner, A. L. (2006). Barriers to treatment adherence for children with cystic fibrosis and asthma: What gets in the way? *Journal of Pediatric Psychology, 31*(8), 846-858
6. Rapoff, M.A., Belmont, J.M., Lindsley, C.B., & Olson, N.Y. (2005). Electronically monitored adherence to medications by newly diagnosed patients with juvenile rheumatoid arthritis. *Arthritis Care & Research, 53*, 905-910.
7. World Health Organization (2003). Adherence to long-term therapies: Evidence for action. Geneva, Switzerland.

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