SUPPLEMENTARY MATERIALS

Development of Group and Family-Based Cognitive Behavioral Therapy Program for Youth at Risk for Psychosis

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S.1. METHODS

Intervention

GF-CBT for Youth at Risk for Psychosis is a 15-week program that includes weekly CBT skills group and individual sessions for adolescents, and a weekly CBT skills group for family members. The program aims to boost family and peer support, reduce isolation, normalize psychotic-like experiences, facilitate positive thinking, enhance reasoning and decision-making skills, reduce cognitive biases, and increase adolescents' ability to make adaptive appraisals of their experiences. We have previously developed and validated Group CBT for Delusions and Group CBT for Paranoia programs aimed at reducing social isolation, biased information processing, and improving reality testing capacity in patients with delusions (1, 2). These programs include group and individual modalities and are grounded in a cognitive model of psychosis (3, 4) and research findings on information processing in delusions (5, 6). An exploratory randomized controlled study demonstrated that patients with schizophrenia successfully used skills learned in the program to reduce paranoia, suggesting the potential of this intervention for the prevention of delusional thinking and paranoia in younger individuals at-risk. We adapted the CBT for Paranoia group program for adolescents with prodromal symptoms, and enhanced the treatment by adding a CBT family group intervention.

GF-CBT is grounded in sociocultural (7) and ecological systems theories (8), psychosocial resilience models (9), a fuzzy-trace theory of emotion, memory and reasoning (10, 11), and research on information processing in delusions (3, 4, 12). The Algo-heuristic method (13, 14) is utilized to teach about and help alter cognitive biases common in delusions. GF-CBT follows principles of the individual CBT for UHR approach (15-17), and group CBT for delusions and paranoia (1, 2), but combines individual and group with family CBT modalities. The intervention recognizes adolescent development as a dynamic process whereby the adolescent impacts and is impacted by the environment. GF-CBT takes into account risk and protective factors at family, community, and individual levels. The involvement of family members is designed to support, encourage, and maintain the use of CBT skills at home, and to help family members cope with their own distressing feelings about their offspring. We adapted CBT for psychosis clinician training program to teach family members CBT skills that they can continue implementing beyond the 15-week program to bolster gains made during the time-limited GF-CBT. GF-CBT also integrates a developmental approach to goal setting (11), taking into account that goals vary with age and evolve over time. The program helps adolescents establish long- and short-term goals, and encourages prioritizing long-term goals. CBT lessons

combine a PowerPoint presentation with participant workbooks that include didactic materials, exercises, and homework (18, 19).

CBT Skills Group for Adolescents includes 15 CBT lessons (Supplementary Table 1). The guiding theory for the CBT intervention is that cognitive biases and other maladaptive cognitive processes may lead to the perception of neutral and anomalous experiences as threatening, which can increase stress and result in higher frequency of psychotic-like experiences. The perception of events as threatening may further lead to avoidance and reduced opportunities for reality testing, and therefore reinforce cognitive inaccuracies, promote the formation of delusions, and interfere with social functioning. By encouraging adolescents to re-evaluate stressful experiences by identifying and modifying maladaptive thoughts, the goal of CBT is to reduce distress and therefore limit the impact of the interference. Main foci of the CBT Skills group are: (1) decreasing adolescents' sense of isolation through participation in a peer group where their experiences are normalized, and (2) increasing adolescents' ability to make adaptive appraisals of their experiences (including anomalous experiences and intrusions, such as hearing a whisper, seeing a shadow, etc.).

To enhance adolescents' ability to make adaptive appraisals of their experiences, we drew upon cognitive developmental neuroscience approaches, specifically fuzzy-trace theory, grounded in research on how people encode, store, retrieve, and process information when they form judgments, and how decision-making changes with development (10, 11). The key principle is that reasoning frequently operates on simple gist (a fuzzy mental representation of the general meaning of information or experience), as opposed to verbatim representation (exact details). GF-CBT aims to help adolescents develop appropriate gist by examining and changing inaccurate and distressing interpretations of events (e.g. "People on the train are laughing. They are laughing at me."). Adolescents learn to identify and attend to relevant cues ("People on the train are laughing. We don't know each other. They are laughing at their own joke."), and to ignore irrelevant cues that may lead to increased suspiciousness ("People on the train are laughing. The kids in my school were making fun of me earlier today. The people on the train are laughing at me."). To achieve this goal, CBT lessons are designed to help adolescents master the following skills: (1) distinguish facts and experiences from beliefs, (2) identify triggers of distressing thoughts and emotional/behavioral consequences of thoughts and beliefs; (3) become aware of, recognize, and correct cognitive biases (e.g. data gathering bias – a tendency to jump to conclusions); (4) become aware of and change behaviors (e.g. isolation) that reinforce delusions, (5) generate multiple explanations for experiences, (6) examine the

utility of beliefs, (7) examine evidence for and against beliefs, (8) systematically apply the above skills to evaluate any judgment and to generate more adaptive interpretations.

The Algo-heuristic approach (13, 14) to teaching general methods of reasoning by facilitating the formation of specific metacognitive skills, is utilized to help adolescents become aware of cognitive biases common in suspicious beliefs (e.g. jumping to conclusions, externalizing, or personalizing) and to develop a less biased information-processing style. Central to the method is getting learners to realize the system of mental operations involved in the cognitive task (e.g. to collect an adequate amount of information in order to avoid jumping to a conclusion) through the following steps: (1) Teaching an individual about a concept and/or procedure of thinking by explanation and demonstration (e.g. defining jumping to conclusions); (2) Formulating strategies to guide learners in selecting appropriate cognitive procedures (e.g. collecting sufficient information and generating hypotheses); (3) Introducing training exercises for acquisition of practical skills; (4) Assisting individuals in learning to use these strategies: being able to deliberately recall them, apply them, and eventually internalize them, so that reasoning tasks are carried out quickly and effortlessly.

Individual CBT for Adolescents: CBT skills learned in group are personalized in individual sessions. Individual sessions alternate with group sessions and are focused on (1) facilitating learning of CBT skills, (2) goal setting and tailoring CBT skills discussed in the group to address adolescents' specific personal goals; and (3) reviewing the individual reaction to the group and addressing concerns in order to enhance ability to successfully function in groups.

CBT Skills Group for Family Members: Group sessions provide a supportive and validating environment where family members gain a better understanding of their offspring's experiences and learn how to prompt them to use CBT skills through effective communication (Supplementary Table 1). Family members are taught CBT skills, in order to facilitate their ability to support adolescents in using CBT skills at home and other settings (e.g., school) and to decrease their own distress due to inaccurate appraisals of events (including situations involving their offspring). To teach family members how to apply CBT skills with their offspring, we use a combination of didactic learning (skills are described (19) and demonstrated via video examples) and practice (skills are role-played in group sessions with an actor trained to play an adolescent prone to paranoia).

Supplementary Table 1: Intervention Elements

CBT Skills Course Taught to Adolescents and Family Members	
Session Number	**Agenda**
Session 1	1. Introduction: Getting to know each other. 2. What is Cognitive Therapy? 3. What is paranoia? 4. What will we do in this group? 5. What makes the group enjoyable? Group rules. 6. Summary. 7. Homework.
Session 2	1. Continue getting to know each other. 2. Review. 3. Personal goals for this group. 4. ABC of Cognitive Therapy. 5. Summary. 6. Homework.
Session 3	1. Continue getting to know each other. 2. Review. 3. How to apply ABC Model to paranoia: 4. Stress as an Activating event. 5. Voice as an Activating event. 6. Summary. 7. Homework.
Session 4	1. Continue getting to know each other. 2. Review. 3. How to apply ABC model to paranoia? 4. What are the consequences of paranoid beliefs and thoughts? 5. Are safety behaviors useful? 6. Summary. 7. Homework.
Session 5	1. Continue getting to know each other. 2. Review. 3. Beliefs about world, self, and others contributing to paranoia. 4. Summary. 5. Homework.
Session 6	1. Continue getting to know each other. 2. Review. 3. Cognitive Biases: Selective Attention. 4. Confirmatory Bias. 5. False Consensus Effect. 6. Summary. 7. Homework.

Session 7	1. Continue getting to know each other. 2. Review. 3. Jumping to conclusions. 4. How else we could explain this event? Gaining information. Looking for alternative explanations. 5. Summary. 6. Homework.
Session 8	1. Continue getting to know each other. 2. Review. 3. Personalizing bias (it's about me). 4. Externalizing bias (someone else is responsible). 5. Summary 6. Homework
Session 9	1. Continue getting to know each other. 2. Review. 3. Can we change our beliefs? 4. How to reality test beliefs? 5. Summary 6. Homework
Session 10	1. Continue getting to know each other. 2. Review. 3. Re-evaluating beliefs step-by-step. 4. Summary. 5. Homework.
Sessions 11-14	1. Continue getting to know each other. 2. Helping each other to evaluate stressful, suspicious beliefs and thoughts, and to develop coping strategies of dealing with them. 3. Summary. 4. Homework.
Session 15	1. Continue getting to know each other. 2. What was most helpful in our group? 3. What do we value about each other? 4. What do we want to remember from the group? 5. Saying goodbye.

CBT Implementation Skills Taught to Family Members

1	Recognizing, identifying, and stating emotions
2	Encouraging expression of feelings
3	Understanding experiences
4	Normalizing experiences
5	Collecting evidence for beliefs
6	Normalizing cognitive processes
7	Columbo Style
8	Encouraging an alternative explanation
9	Offering an alternative explanation

10	Parsing evidence
11	Shared decision making about belief alteration
12	Resolving ambivalence
13	Focusing on personal goals
14	Learning from this Experience for the Future
15	Summarizing and reflecting back
16	Praising efforts

Supportive Individual CBT for Adolescents

CBT skills learned in group are personalized in individual sessions. Individual sessions are focused on:

1. Facilitating learning of CBT skills.

2. Goal setting and tailoring CBT skills discussed in the group to address adolescents' specific personal goals.

3. Reviewing the individual reaction to the group and addressing concerns in order to enhance ability to successfully function in groups.

Family members can join adolescent's individual sessions as needed, and if agreed to by the adolescent.

Measures

Supplementary Table 2: Interrater Reliability

Variable	ICC
CAARMS Total Global	.930
CAARMS Total Frequency/Duration	.934
CAARMS Positive Global	.799
CAARMS Positive Frequency/Duration	.842
SOFAS	.778
PANSS Total	.971
PANSS Positive	.939
PANSS Negative	.941
PANSS General	.979
PANSS P6	.750
CBTSF-S	.781

Abbreviations: ICC = Intraclass Correlation Coefficient, CAARMS = Comprehensive Assessment of At Risk Mental States, SOFAS = Social and Occupational Functioning Scale, PANSS = Positive and Negative Syndrome Scale, P6 = Persecution, CBTSF-S = Cognitive Behavioral Therapy Skills for Families Scale

Supplement 3: The Cognitive Behavioral Therapy Skills for Families Scale (CBTSF-S)

The Cognitive Behavioral Therapy Skills for Families Scale (CBTSF-S) was developed to measure family members' proficiency at using CBT skills when communicating with their relatives who are at risk for psychosis. Actors were trained to play at-risk adolescents and conduct two role plays with each family member. The first role play assesses the family member's proficiency at using CBT skills when their at-risk relative is experiencing paranoia in a public setting, and simulates a discussion that takes place after the relative has had the experience of believing people on the train-ride home were laughing at him or her. The second role play assesses the family member's proficiency at using CBT skills when their at-risk relative is experiencing paranoid thoughts targeted at them, and simulates a discussion that takes place when the at-risk relative believes the family member has been reading through their private journal. For both role plays, the family member is given a brief description of the situation beforehand and is told that their task is to engage their relative in conversation and to show empathy and concern and be as helpful as possible. The actor is given a more comprehensive description of the situation, as well as guidelines on how to behave, how to respond to questions and statements, and what the goal of the role play is. Role plays continue until some conclusion is reached or until the family member no longer wishes to continue.

The role plays are videotaped and independent raters score the family member's use of CBT skills using the twenty-one item CBT Skills for Families Scale (CBTSF-S). For each of the ninghteen skills listed on the scale, the rater determines whether or not the skill was needed for a particular role play, whether or not it was used, and then how effectively it was used on a 5 point Likert-scale ranging from poor to excellent. A total score is calculated by summing the scores for each of the skills that were needed (giving skills needed but not used a score of 0) and then dividing by the total number of skills needed.

Skill	Was Activity Needed? (No=0, Yes=1)		Was Activity Applied? (No=0, Yes=1)		Poor	Mediocre	Satisfactory	Good	Excellent
1. Correctly recognizing, identifying, and stating emotions. Did the parent correctly recognize adolescent's emotions and state them to show understanding?	0	1	0	1	1	2	3	4	5
2. Encouraging expression of feelings. Did the parent ask the adolescent about their feelings or facilitate the expression of feelings?	0	1	0	1	1	2	3	4	5
3. Understanding experiences. Did the parent ask the adolescent questions in order to understand exactly what happened?	0	1	0	1	1	2	3	4	5
4. Normalizing experiences. Did the parent help the adolescent realize that their experiences (or symptoms) are not uncommon?	0	1	0	1	1	2	3	4	5
5. Collecting evidence for beliefs. Did the parent assess the evidence that the adolescent used to support their beliefs?	0	1	0	1	1	2	3	4	5
6. Normalizing cognitive processes. Did the parent help the adolescent realize that their conclusion makes sense considering information that they had available?	0	1	0	1	1	2	3	4	5
7. Encouraging an alternative explanation. Did the parent encourage adolescent to consider a possibility of alternative explanation?	0	1	0	1	1	2	3	4	5
8. Offering an alternative explanation. Did the parent provide the adolescent with an alternate explanation that may be more reasonable and less distressing?	0	1	0	1	1	2	3	4	5
9. Parsing evidence. Did the parent help the adolescent to look at the evidence for and against their beliefs?	0	1	0	1	1	2	3	4	5
10. Shared decision making about belief alteration. Did the parent assist the adolescent in choosing which belief is the most plausible or beneficial?	0	1	0	1	1	2	3	4	5

Skill	Was Activity Needed? (No=0, Yes=1)		Was Activity Applied? (No=0, Yes=1)		Poor	Mediocre	Satisfactory	Good	Excellent
11. Resolving ambivalence. Did the parent help the adolescent resolve their uncertainty about a possible course of action by looking at pros and cons?	0	1	0	1	1	2	3	4	5
12. Planning for the future to prevent reoccurance. Did the parent discuss with the adolescent possible ways to handle a similar situation in the future?	0	1	0	1	1	2	3	4	5
13. Focusing on personal goals. Did the parent attempt to remind adolescent about their personal goals when considering an alternative explanation or developing a plan of action?	0	1	0	1	1	2	3	4	5
14. Engagement. Did the parent pay particular attention to issues that would facilitate the engagement of the adolescent?	0	1	0	1	1	2	3	4	5
15. Summarizing and reflecting back. Did the parent summarize and restate what adolescent said to show understanding?	0	1	0	1	1	2	3	4	5
16. Columbo style. Did the parent help the adolescent to explain their reasons for holding a belief by apologizing for being confused, but carefully questioning to gain the details?	0	1	0	1	1	2	3	4	5
17. Praising efforts. Did the parent praise the adolescent's attempts the cope and make positive changes?	0	1	0	1	1	2	3	4	5
18. Empathically respond to emotional experience. Did the parent respond to the adolescent's experience in a sensitive and understanding manner?	0	1	0	1	1	2	3	4	5
19. Guided discovery. Did the parent assist the adolescent in developing a new perspective by asking them questions about their situation, symptoms or experience?	0	1	0	1	1	2	3	4	5

S.2. RESULTS

Therapeutic Alliance and Group Therapeutic Factors

Supplementary Table 4: Therapeutic Alliance and Group Cohesiveness

Scale	Adolescents	Parents
	Mean (SD)	Mean (SD)
WAI- Tasks (1,7)	6.17 (0.98)	6.47 (0.77)
WAI- Goals (1,7)	6.50 (0.55)	6.64 (0.43)
WAI- Bond (1,7)	6.33 (1.21)	6.79 (0.29)
WAI- Global (1,7)	6.33 (0.91)	6.63 (0.50)
Empathy Scale Total (-15, 15)	14.17 (1.17)	13.50 (2.81)
Group Cohesiveness Scale (9,63)	59.50 (2.43)	55.20 (3.56)

Abbreviations: SD = Standard Deviation, N = 6, WAI = Working Alliance Inventory, Scores range from 1 to 7, with higher scores indicating stronger alliance.

Supplementary Table 5: Therapeutic Factors in Adolescent and Parent Groups

Therapeutic Factor	Adolescent Rank	Parent Rank
Altruism[A]	1	3
Instillation of Hope[B]	2	5
Group Cohesion[C]	3	2
Guidance[D]	4	4
Universality[E]	5	1
Self-Understanding[F]	6	8
Interpersonal[G]	7	6
Catharsis[H]	8	7

Abbreviations: Rankings collected from a method used to assess the perceived benefits of non-specific therapeutic factors in group therapy in which participants ranked phrases from 1 (most helpful) to 8 (least helpful). Ranking is ordered based on the mean rank score for each group.

[A] Helping others and being important in their lives
[B] Seeing that others had solved problems similar to mine
[C] Belonging to and being accepted by a group
[D] Someone in the group giving definite suggestions about a life problem
[E] Learning I'm not the only one with my type of problem
[F] Discovering and accepting previously unknown/unacceptable parts of myself
[G] Feeling trusting of groups and of other people
[H] Learning how to express my feelings

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