In Brief

Problem solving is an essential skill for effective diabetes self-management. Evidence suggests that problem-solving therapy (PST) approaches, used in the context of broader diabetes educational or lifestyle interventions, may be effective for mood and select diabetes outcomes. As a stand-alone treatment, formal PST adapted for diabetes self-management is a promising behavioral intervention for improving health-related problem-solving, diabetes self-care behaviors, and disease control.

Evidence-Based Behavioral Treatments for Diabetes: Problem-Solving Therapy

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Problem solving is a basic human thinking process. Many general counseling and psychotherapy approaches, such as cognitive behavioral therapy, include problem solving as a component of treatment for managing life problems and emotional disorders.[1] Similarly, educational and lifestyle interventions in diabetes often include elements of problem solving as part of broader intervention approaches.[2]

Among diabetes educators, problem solving is identified as necessary for patient mastery of diabetes self-management and as the skill most difficult to teach patients.[3] This article describes the origins of problem-solving therapy (PST) as a formal, stand-alone intervention approach for behavior change; application of this technique to diabetes care; and evidence of its effectiveness in improving diabetes outcomes.

Origins of Problem Solving as a Behavioral Treatment

Problem solving, which has its origins in the behavioral and cognitive basic sciences,[4–8] is an identified intervention approach for behavior change.[9,10] Cognitive psychology defines problem solving as involving the following components: the individual is goal-directed; reaching the goal requires a series of mental processes; and those processes are cognitive rather than automatic.[6,7] Problem solving can perhaps be described more simply as a series of cognitive operations used to figure out what to do when the way to reach a goal is not apparent.

Although problem solving is a counseling approach that may be incorporated within other intervention models, PST is a stand-alone intervention with a longstanding history. PST took root in clinical and counseling psychology in the 1960s and 1970s to address a variety of mental health disorders, including schizophrenia and psychotic disorders, depression and suicidality, social phobia, generalized anxiety disorder, and posttraumatic stress disorder.[11,12] PST has also been used to address marital/family distress, lifestyle management in people with mental retardation, stress management, ineffective coping, and substance abuse.[11]

There is a substantial evidence base for the effectiveness of PST in reducing symptoms of depression, anxiety, and stress.[12] Moreover, problem-solving approaches have been found effective in helping patients cope with cancer, enhancing weight loss maintenance, reducing pain, and lowering blood pressure.[12–16]

The PST model proposed by D'Zurilla and Goldfried[9] and refined by D'Zurilla and Nezu[11] is perhaps the most recognized PST approach. This intervention approach is based on the premise that humans are innate problem solvers but that there are significant individual differences in problem-solving abilities.

PST has historical roots in four different areas: *1*) increased focus on human creativity, creativity research, and creative problem solving; *2*) a positive approach to clinical intervention,

which moves away from the medical model of pathology and focuses on building social competence through enhancing problem-solving abilities; *3*) recognition of the importance of cognitive processes and self-control in behavior therapy, in which PST intends to teach patients a skill set they can apply across all life situations, resulting in generalized and lasting behavior change; and *4*) Lazarus's relational model of stress, which describes stress as a result of person-environment interactions where the demands of the interaction exceed the individual's coping resources.[17]

D'Zurilla and Nezu[11] describe three levels of variables influencing the cognitive-behavioral process of problem solving. PST is effective in facilitating behavior change by intervening on these three levels. First, *orienting responses* refer to how individuals respond to problematic situations in terms of their thoughts and emotions. PST intervenes on these responses by teaching individuals how to effectively recognize and appraise problems while increasing their self-efficacy to cope with challenging situations. Second, *problem-solving skills* refer to the specific tasks that must be completed before a problem can be solved successfully. PST intends to teach problem-solving skills, thereby improving individuals' ability to manage challenging situations. Finally, basic *cognitive abilities* refer to specific abilities that directly affect individuals' capacity to learn and perform problem-solving skills. Examples of basic cognitive abilities include causal thinking, consequential thinking, and perspective taking.

Interventions often focus primarily on the first two levels because it is typically assumed that individuals come to treatment with basic cognitive abilities intact. This assumption may be incorrect for specific populations (e.g., people with schizophrenia), in which case deficits in this area should be included in the intervention.[11] PST also intervenes on individuals' emotional responses to life situations, which have a significant effect on all aspects of problem solving. PST aims to facilitate positive emotional reactions and reduce or eliminate negative emotional reactions (e.g., anxiety and anger).[11]

Key components of PST are provided in Table 1. The D'Zurilla and Nezu[11] PST uses a five-dimensional model of social problem solving, which includes two problem-orientation styles (positive and negative) and three problem-solving styles (rational, impulsive/careless, and avoidant). The model also identifies four rational problem-solving skills: problem definition and formulation, generation of alternatives, decision making, and solution implementation and verification. PST must be conducted in a sequential order, and a series of problem-solving therapy modules is available.[11]

Table 1. Traditional PST

Key Components	Description
Evidence-based clinical applications	Schizophrenia and psychotic disorders, depression and suicidality, social phobia, generalized anxiety disorder, post-traumatic stress disorder, marital/family distress, mental retardation, stress management, ineffective coping, substance abuse
Number of sessions	8–15
Modules	Module 1: Initial structuring Module 2: Problem-solving assessment Module 3: Obstacles of effective problem solving: limited capacity of the conscious mind Module 4: Problem orientation: introduction and fostering self-efficacy beliefs Module 5: Problem orientation: problem recognition Module 6: Problem orientation: viewing problems as challenges Module 7: Problem orientation: use and control of emotions in problem solving Module 8: Problem orientation: STOP and THINK! Module 9: Problem definition and formulation Module 10: Generation of alternative solutions Module 11: Decision making Module 12: Solution implementation and verification Module 13: Guided practice Module 14: Rapid problem solving (optional) Module 15: Communication skills and interpersonal problem solving (optional)
Supporting patient materials	*Solving Life's Problems: A 5-Step Guide to Enhanced Well-Being*[18]
Techniques used	Didactic approaches (psychoeducation and Socratic teaching methods), coaching (facilitation of the problem-solving process), modeling (facilitator-provided examples of hypothetical problems), shaping (teaching problem solving in a series of hierarchical steps), rehearsal (practicing skills with take-home exercises), performance feedback (facilitator and self-monitoring of progress in problem solving), and positive reinforcement (provided by natural environment, facilitator, and group members if conducted in this format)
Related assessments	Social Problem-Solving Inventory, Short/Long Form[19]

The number of sessions required to complete PST varies depending on the purpose of the training, but ranges from 8 to 16 sessions.[11,12] The interventionist conducting PST uses didactic approaches, coaching, modeling, shaping, rehearsal, performance feedback, and positive reinforcement. Nezu et al.[18] have developed a user-friendly self-help guidebook to assist in training professionals in PST and to serve as a supporting reference for patients engaging in therapist-led PST. Successful implementation depends on adequate development of rapport between the facilitator and the patient(s). To evaluate success of PST, an assessment tool such as the Social Problem-Solving Inventory–Revised[19] is also recommended.

Application of PST to Diabetes: What Is the Evidence?

The American Association of Diabetes Educators (AADE) has identified problem solving as one of seven core diabetes self-management behaviors (AADE-7).[20] AADE defines problem solving as a learned behavior that includes generating a set of potential strategies for problem resolution, selecting the most appropriate strategy, applying the strategy, and evaluating the effectiveness of the strategy. In the AADE-7 framework, problem solving is conceptualized as intervening on barriers to self-care[21,22] and thereby enabling patients to carry out all other self-management behaviors (i.e., healthy eating, physical activity, self-monitoring, medication taking, risk reduction, and healthy coping).[2]

Hill-Briggs[21] proposed a model for understanding problem solving in the context of diabetes self-management. Based on the D'Zurilla and Nezu framework combined with theories of problem solving from cognitive psychology and education/learning theory, the model highlights four key components of problem solving that are particularly salient in disease self-management. First, *problem-solving skill* refers to the approach an individual takes to solving problems (i.e., rational, impulsive/careless, or avoidant), with a rational approach being most effective. Second, *problem-solving orientation* refers to individuals' attitudes and beliefs about their disease and the problems they encounter. Problem-solving orientation can be positive (e.g., problems viewed as a challenge) or negative (e.g., problems viewed as a threat). Third, *transfer of past experience/learning* refers to the use of previous experience in attempting to solve novel problems. This transfer of past experience can also be effective (e.g., using a solution that was effective in a similar situation in the past) or ineffective (e.g., trying an ineffective solution repeatedly in the same situation). The fourth component of problem solving is *disease-specific knowledge*. To solve problems related to disease self-management effectively, individuals must have a working knowledge base about the disease and its management. Each key component of problem solving operates within the *problem environment*, composed of the social/physical context and characteristics of the problem itself.[23]

The evidence base for problem solving as a diabetes self-management intervention approach was examined in a 2007 systematic review.[2] This review revealed problem solving as a frequently used component of interventions within diabetes education and care. Research with adult populations has demonstrated some effectiveness of interventions with a problem-solving component on outcomes including disease control, depressive symptoms, self-management behaviors, weight loss, self-efficacy, and quality of life. Research with children/adolescents has demonstrated effectiveness of problem-solving training in improving some self-management behaviors and psychosocial outcomes.[2]

Specifically, the review[2] yielded 36 quantitative, 11 conceptual, and 5 qualitative studies of problem solving in diabetes self-management and control. Studies examined in the review were conducted with children/adolescents (43%) and adults (57%). The samples were varied in terms of race and ethnicity, with Caucasian (25%), multiple ethnicities (most often Caucasian, African-American, and Latino) (22%), African-American (11%), and international (Japanese, Italian) (8%) populations represented.

Intervention studies were conducted with children/adolescents (n = 8) and adults (n = 8). The extent to which problem solving was involved in the intervention varied, but in most cases, problem solving was one component of a larger diabetes self-management intervention and was not the main focus of treatment. Outcomes reported in the systematic review included problem solving, self-management behaviors, physiological outcomes, and psychosocial outcomes.[2] Two of five studies with children and both studies with adults in which problem solving was assessed demonstrated a positive effect of the intervention on problem-solving ability. The studies with adults demonstrated maintenance of problem-solving abilities at follow-up (6 months and 5 years later).[2]

Twelve studies reported use of an intervention that was problem-solving based or included problem solving in a broader package of intervention approaches. Three of six studies with children demonstrated a positive effect of the intervention on dietary intake, self-monitoring of blood glucose (SMBG), and general treatment adherence, with effects lasting for up to 12 months. Additionally, four of six studies in adults demonstrated positive effects of the intervention on dietary behaviors (most common), SMBG, and exercise. Findings related to medication adherence in adults were mixed, and one study demonstrated no link between problem solving and foot inspections.[2]

All but two intervention studies assessed the effect of problem-solving training on glycemic control. Half of the adult studies demonstrated a positive effect of the intervention on A1C. The results in children/adolescents were even more mixed, with two studies showing a decrease in A1C, three studies showing no effect on glycemic control, and one study reporting higher A1C at follow-up in both the intervention and control groups.[2]

Two studies demonstrated a positive effect of the intervention on weight loss in adults, whereas one study demonstrated no effect on weight loss. Finally, two studies demonstrated a positive effect of the intervention on cardiovascular disease (CVD) markers (cholesterol and triglycerides).[2]

Three intervention studies assessed psychosocial outcomes in children/adolescents. Results indicated a positive effect of the intervention on self-efficacy, adjustment, parent-adolescent relationships, diabetes-related conflict, ability to use sick-day self-management guidelines, and quality of life. One study conducted with adults demonstrated a positive effect of the intervention on self-efficacy, whereas the other showed no effect on self-efficacy. Three studies with adults

reported improvements in depressive symptoms post-intervention. Of the three studies that investigated quality of life in adults, two found no differences between the intervention and control groups in quality of life, whereas one showed improved quality of life in the intervention group.[2]

Several limitations in the research reviewed affected the conclusions that could be drawn regarding the effectiveness of PST for diabetes self-management. In the diabetes interventions reported to date, problem solving generally was added to self-management training as a very small, informal, or unstructured component within a package of intervention techniques and without incorporating all elements that constitute PST as a behavior-change intervention. Therefore, it has been difficult to determine to what extent problem solving (compared to the other offered interventions) contributed to outcomes. Moreover, few studies provided a description of the problem-solving component of the intervention package. Nonetheless, as a whole, evidence suggests that problem solving–related interventions are effective for select diabetes outcomes.

Example of Traditional PST Applied to Diabetes Self-Management

Not previously tested was whether traditional PST as a stand-alone intervention rather than a small component of a broader intervention package is effective for diabetes self-management and disease control. This was the focus of a recent investigation and is the subject of an ongoing trial.

Project DECIDE (Decision-making Education for Choices In Diabetes Everyday) began as a study funded by the National Institutes of Health (NIH) to translate traditional PST into a problem-based diabetes self-management training program. The DECIDE intervention centers on a series of learning modules that train patients in the problem-solving process as a life skill applied to diabetes self-management. This skill-training approach allows health/diabetes educators to relinquish the role of patients' problem-solver, a role that inadvertently disempowers patients.[24] For patients, the problem-based self-management approach allows them to identify and work toward solutions for daily barriers, life challenges, and competing priorities that directly impede their effective application of diabetes knowledge and self-management of diabetes in real life.

Key components of the DECIDE self-management training are provided in Table 2. The DECIDE program consists of a diabetes and CVD education module, which provides the booster patient education needed as a prerequisite for diabetes-related problem solving, followed by health-related problem-solving training modules modeled on the described D'Zurilla and Nezu approach.[11] Patients receive two workbooks: *Diabetes and Your Heart: Your Facts and Information Workbook*, which accompanies the education module, and *Hitting the Targets for Diabetes and Your Heart: Your Problem-Solving Workbook*, which accompanies the problem-solving training. The problem-solving modules also include take-home exercises, which provide opportunities for patients to practice newly learned problem-solving skills in their natural environments. Both patient workbooks were developed using guidelines for accessibility and usability for vulnerable adult populations[25–28] and have been found to be accessible and understandable to people with low and average literacy,[29] as well as peo-

Table 2. DECIDE Diabetes PST

Key Components	Description
Evidence-based clinical applications	Diabetes self-management
Number of sessions	9
Modules	Diabetes and CVD education module Problem-solving module 1: overview of problem solving Problem-solving module 2: taking control of stress and emotions (problem orientation) Problem-solving module 3: what makes a problem a problem? (problem identification) Problem-solving module 4: know thyself: set goals that fit your life (goal setting) Problem-solving module 5: different ways to reach health goals: knowing your options (generating alternative solutions) Problem-solving module 6: that sounds good but does it work for me? (decision making) Problem-solving module 7: take action and know the signs (solution implementation and verification) Problem-solving module 8: putting it all together (review and reinforcement)
Supporting patient materials	*Diabetes and Your Heart: Your Facts and Information Workbook* *Hitting the Targets for Diabetes and Your Heart: Your Problem-Solving Workbook*
Techniques used	Didactic approaches, coaching, modeling, shaping, rehearsal, performance feedback, and positive reinforcement
Related assessments	Diabetes Problem-Solving Scale[30] Health Problem-Solving Scale[31]

ple with mild to moderate visual and cognitive impairment.[30]

The pilot study tested a comprehensive DECIDE PST intervention (as shown in Table 2) and a condensed version, which consisted of the diabetes and CVD education module followed by one PST session. The condensed PST intervention and patient workbook covered all the problem-solving topics with abbreviated exercises. The study used two measures designed to assess problem solving in the context of health: the Diabetes Problem-Solving Scale[31] and the Health Problem-Solving Scale.[32]

The pilot study was conducted with an underserved patient population. Participants were 56 African Americans (59% female, mean age 61 years, 57% living in poverty) with a mean diabetes duration of 14 years. The vast majority of patients (86%) had suboptimal A1C (defined as > 7.0%).[33] Participants were randomized to the intensive (n = 29) or condensed (n = 27) DECIDE programs, which were delivered in group format.

At 3 months after intervention completion (6 months to 1 year from baseline), the intensive DECIDE PST resulted in improved diabetes knowledge, problem solving, and self-care and a reduction in A1C of 0.71%. For participants with suboptimal blood pressure or LDL cholesterol, benefits in these parameters were seen as well. The condensed intervention resulted in knowledge gain but not problem solving or clinical improvements. The study demonstrated that a diabetes PST delivered with the intensity of traditional PST (eight problem-solving sessions) was an effective intervention in a challenging adult patient population.[34] Participants in both the intensive and condensed interventions rated the problem solving–based self-management training as highly satisfactory, helpful, and easy to understand.[34]

Current and Future Research Directions

Investigations are underway to test the effectiveness of different formats for delivery of the DECIDE approach to PST (i.e., self-study, individual, and group formats) and for greater dissemination (e.g., Internet-based and electronic education platforms) to patients who may benefit from this approach across clinic and community settings. Additionally, a search of active, federally funded research grants using the NIH RePORT database revealed a number of current research projects investigating problem solving among children/adolescents, ethnic minorities, and families. These studies generally describe use of problem solving as an intervention component rather than PST as a stand-alone intervention.

Future research should provide evidence of the effectiveness of PST across populations (e.g., different age-groups, sexes, and racial/ethnic minority groups for whom effectiveness of this approach has not yet been reported, including Asians, Latinos, and Native Americans). Additional research is needed to evaluate and disseminate effective tools for health care professionals' use in implementing problem-solving training and to establish best practices for training health care professionals in the delivery of problem-solving education to patients.

Conclusion

PST, both in its traditional format and in formats adapted for diabetes self-management, can be effective for multiple outcomes of interest to health care professionals treating patients with diabetes. A recent statement from a panel convened by AADE on the current state of the science of problem solving concluded that evidence supports problem solving as an important process, intervention, and skill in diabetes self-management.[35] It teaches patients the skills necessary to achieve goals related to recommended self-care behaviors.

Teaching the problem-solving process to patients is an important role health care professionals can play. Further attention is needed to the skills, experiences, and expectations health care professionals bring to problem-solving interventions and to ensuring that professionals are able to conduct thorough assessments and interventions using this approach.[35]

Although the activities of problem solving tend to be included routinely in clinical encounters, it is important that clinicians be able to distinguish between *using* the problem solving process with patients and *teaching* patients problem-solving as a self-management and life skill. Training patients in problem solving can be done using diabetes-focused PST. There remains a need for dissemination of effective problem-solving training materials and increased formal training opportunities for health care professionals interested in using this approach.

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