Author’s response to reviews

Title: Planning and problem-solving training for patients with schizophrenia: A randomized controlled trial

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Author’s response to reviews: see over
Dear Editor,

We would like to thank you for the opportunity to revise our manuscript “Planning and problem-solving training for patients with schizophrenia: A randomized controlled trial”. The reviewer’s comments were very helpful in improving the manuscript, in particular with respect to placing the study and its findings more accurately in the context of the broader literature. Below please find a point-to-point reply and indication of the changes made to the manuscript. We hope that this revision renders the paper suitable for publication in BMC Psychiatry and look forward to hearing from you.

With best regards,

Stefan Kaiser
Abstract

Remove “a” after “whether” in sentence 1.

Done.

Methods: I think the two hypotheses should be of equal status—I don’t think the planning outcome measures should be part of a “secondary hypothesis”—you can’t (or shouldn’t) have improvement in one without the other.

We have now equally weighted the outcome measures as follows:

“Outcome variables included planning and problem-solving ability as well as functional capacity, which represents a proxy measure for functional outcome.”

Results: I don’t think it is accurate to say improvement on one outcome measure does not “generalize” to another, similar outcome measures. Rather the training in the intervention does or does not generalize to outcome measures different from the training itself.

We have rephrased this part of the results accordingly.

“Planning and problem-solving training improved one measure of planning and problem-solving more strongly than basic cognition training, while two other measures of planning did not show a differential effect.”

We have also adapted the conclusion to better reflect the changes in the manuscript made in response to the reviewer’s comments below:

“A differential effect of targeting specific cognitive functions on functional capacity could not be established. Small differences on cognitive outcome variables indicate a potential for differential effects. This will have to be addressed in further research including longer treatment programs and other settings.”

Introduction

1. To this reader it is unfair to describe what the authors label “the first-generation” of cognitive remediation studies as lacking theoretical motivation. The Benedict et al. study was motivated by data-driven theories about information processing difficulties in schizophrenia as measured by the degraded stimulus CPT. Also, the authors are encouraged to look at and cite even earlier cognitive training studies by Meichenbaum, Koh and others for a richer view of the history of this work.

We agree with the reviewer that this part of the introduction did not adequately reflect the theoretical motivation of earlier studies of cognitive remediation. We have now divided this part of the introduction in two paragraphs to provide a more comprehensive history of the work and the motivation for the present study.

In the first paragraph we give a brief summary of the development from studies addressing specific tasks to more comprehensive programs (page 3):

“The dominant research focus in the 1980s and 1990s was on training procedures addressing a particular construct or even a specific task. Most prominently this included sustained attention based on findings in the Continuous Performance Test and executive function based on Wisconsin Card Sorting Test performance [9, 10]. These studies were mostly focused on the question whether cognitive deficits can be remediated through training. Recently, more comprehensive training packages addressing a set of target functions have dominated the literature (e.g. [5, 11]). This goes along with a shift in outcome measures. After many of the earlier studies sought
to demonstrate improvement on the task trained, a broader effect on neuropsychological test performance has subsequently been considered a condition for improvement of patient relevant outcomes [12]. There is also a growing consensus that trials aimed at improving cognition should assess functional outcome directly or through an appropriate proxy measure [13]. Accordingly, functional outcome measures have been included in most recent trials of cognitive remediation (e.g. [14, 15])."

In the second paragraph we make the point that despite this large body of research, we know very little about whether targeting some functions might be preferable over others. We also include the early studies by Wagner and Meichenbaum here, which have already raised these issues to some extent (page 3-4).

"Interestingly, the earliest studies of cognitive remediation in schizophrenia have addressed this question to some extent. Wagner trained patients on a stimulus discrimination task with and without requirement for abstraction, but did not find a consistent advantage of one form of training [17]. Bellack and colleagues compared trained participants on either the Wisconsin Card Sorting Test or the Halstead Category Test. The authors could show that both groups improved on the non-trained test. However, these tasks involve strongly related cognitive operations and a differential effect on other cognitive functions was not the goal of the study [18]. Another line of research focused on strategies taught during training [19, 20]. However, these latter studies have not included comparisons between training of different functions or tasks. Thus, it is still an open issue whether the training of certain specific functions is more effective than training of other functions. This question is pertinent in the clinical context, where therapists often employ a mix of training interventions adapted to setting and patients."

2. Could the authors describe the problem-solving training in Medalia et al (2000) in more detail so that it can be compared to the current intervention? I believe the two methods are quite different in approach.

We have now included a brief description of the program used by Medalia in the introduction (page 4):

"Participants in the problem-solving remediation group worked under individual supervision with the software program Where in the USA is Carmen Sandiego? This educational software was selected, because it requires a range of problem-solving skills and was considered to promote intrinsic motivation."

A more detailed discussion of similarities and differences between the Medalia program and our own training approach has now been included in the discussion (please see point 5. under discussion below for detail).

3. Almost as many neurocognitive deficits as have been identified in scz have also been linked to different aspects of outcome in schizophrenia. The authors need to make a stronger argument that there is something unique about planning and problem-solving, relative to other cognitive functions, as a predictor of outcome in scz.

In order to better highlight the motivation for our approach, we have now included recent research showing a strong relationship of planning and problem-solving with a set of functional outcome measures in schizophrenia. This research pertains specifically to real-world approximating tasks with high face validity, which we use both in the training as well as in the assessment procedures. These arguments are now included on page 4:

"Planning and problem-solving have received increased interest, because recent developments in the assessment of executive functions with high ecological validity have been applied to the study of patients with schizophrenia [23, 24]. Interestingly, planning performance on tasks with real-world approximating interface and complexity has been associated with functional outcome and related proxy measures [25-27]. This includes overall performance on the naturalistic action test, community functioning and global assessment of functioning. These studies have suggested a particular role for planning and problem-solving in cognitive remediation, but have so far not provided direct evidence."

4. There is almost no detail on the elementary cognitive training package. Was task-difficulty manipulated? Can the authors be more explicit on the details of the domains trained in the
We now briefly introduce the target functions of the basic cognition intervention in the introduction (page 5):

"The comparison group trained on the basic cognitive functions processing speed, memory and attention/concentration, which have all been consistently shown to be impaired in patients with schizophrenia [32, 33]. These training tasks were carefully selected to not include planning and problem-solving components."

Task difficulty increased over the course of the basic cognition training. We have added the parameters for manipulation of task difficulty to the description of the intervention in the methods section (page 9):

"(1) Processing speed: the task includes the presentation of visual stimuli that have to be responded to as quickly as possible. Increasing levels of difficulty were characterized by an increasing size of the stimulus set and progression from single to multiple choice reactions. (2) Attention and concentration: one picture shown separately has to be compared with and found among three to nine other pictures. Stimulus discriminability and set size increased with progression through levels. (3) Topological memory: the task is divided into two phases - acquisition and reproduction - of three to sixteen objects. Increasing levels of difficulty in the memory task were characterized by an increasing number of items to be retained. Patients were not instructed to use specific strategies for the basic cognition tasks."

Participants progressed through a set of different levels over the course of the training as characterized by the parameters mentioned above. We have now included the mean levels reached after the first and the last session of the training for both interventions (page 12-13):

" Progress over the course of training
To assess the progress of participants over the course of training we provide the mean levels reached by the group at the end of the first and last training sessions. The Plan-A-Day group progressed from level 13 (range 6-25) to level 40 (range 31-54). The basic cognition group progressed over the course of the training as follows: Memory level 5 (range 2-8) to level 10 (range 3-16), attention level 6 (range 4-8) to level 16 (range 10-20) and processing speed level 2 (range 1-3) to level 10 (4-13)."

5. I think the two hypotheses should be of equal stature, with the effects on the more proximal outcome stated first (planning ability) and the effects on functional capacity second.

We have re-arranged the hypotheses as suggested by the reviewer (page 5):

(1) Planning and problem-solving training leads to stronger improvement of planning ability than training of basic cognition.
(2) Planning and problem-solving training leads to stronger improvement of functional capacity than training of basic cognition.

Discussion

1. The results of this study do not support the idea that cognitive training enhances work therapy programs –it is just as possible that work therapy would have produced similar improvements in the absence of any cognitive training.

We completely agree with the reviewer that the lack of a control group without cognitive intervention precludes a conclusion about the causal role of these interventions in the overall improvement seen in both groups. This is now stated more clearly. We further discuss the possible role of work therapy in improving functional capacity and cognitive functioning (page 14).
"Therefore, it is not clear whether our training interventions constitute a causal factor in these general improvements. The first alternative explanation to be considered are unspecific treatment effects resulting for example from hospitalization and medication. However, patients in the study were clinically stable and normally do not present short term fluctuations in performance. Another important issue is a possible effect of the intensive work therapy program on functional capacity as well as cognitive functioning. Beneficial effects of rehabilitation programs including work therapy on the OAF-P functional capacity measure have been demonstrated, although over a longer time frame [53]. Furthermore, Bell and colleagues have suggested that work therapy alone can improve cognitive functioning as it challenges memory and other cognitive functions [54]. However, to our knowledge no study has compared work therapy with a control condition in its effect on cognition."

2. Also, can the authors consider the possibility that the work therapy may be producing some of the gains in cognitive function evident in both groups in this study?

This is an important consideration, which has also been suggested by Bell and colleagues (2007 in Journal of Rehabilitation Research & Development). However, there are, to our knowledge, no studies comparing work therapy with a control condition with respect to cognition. This issue is discussed in conjunction with the effects of work therapy on functional capacity (see discussion point 1 above).

3. I think the findings that the planning training produced changes in the planning outcome measure should be emphasized as it suggests that the intervention was effective at improving planning abilities. This finding is of crucial importance. If available it would be nice to see a similar effect for the cognitive training package to show that it worked.

According to the reviewer's suggestion, we have now focused more strongly on the results regarding planning and problem-solving. In addition, basic cognition training led to an improvement in Stroop neutral reaction time as a measure of processing speed.

In order to put more emphasis on these results, we have included both results in the first paragraph of the discussion (page 14):

"Planning and problem-solving training led to stronger improvement on one measure of planning and problem-solving, while basic cognition training had a stronger effect on one measure of processing speed. However, there was no differential effect between interventions on functional capacity. We discuss the effects observed in both training groups first and then focus on the differential effects between treatments as the main objective of the study."

In addition, we have expanded the discussion of the results for planning and problem-solving on page 15 to include the differences between the planning measures and the potential for transfer to functional outcome (page 15, 1st and 2nd paragraph):

"This difference in complexity might explain the difference in effects. In the training program, participants learn to deal with planning demands typical for real-world environments, for example involving goal conflicts requiring to skip one element. These are strategies, which are unlikely to be helpful in tasks like the Tower of London, which always have a complete and unequivocal solution."

"However, the improvement of the planning and problem-solving group specifically on the task most closely approaching real-world requirements suggests a potential for successful generalization to functional outcomes."

4. The authors should also note that generalization of training effects to distal outcome measures, like work function, has not been documented in recent large-scale studies (see Dickinson et al., 2010).

We now clearly acknowledge this critical issue and consider the possibility that the lack of a differential effect reflects that none of the interventions had an influence on functional capacity (page 14-15):
“Although there is meta-analytic evidence for an effect of cognitive remediation on functional outcome or respective proxy measures, this issue still remains controversial in the light of well-conducted studies with negative results [4, 15]. Thus, one way to explain the absence of a differential effect would be that none of the two interventions had an effect on functional capacity.”

5. In comparing their results to those of Medalia could the authors compare the training packages? Could the authors could place their training on a continuum from drill-and-practice restorative training to compensatory training and compare that with the training approach of Medalia et al.?

We have now compared the training packages in more detail with respect to cognitive functions addressed, strategy teaching and promotion of intrinsic motivation (page 16). We suggest that both interventions (Medalia and our own) can be placed on a middle ground between drill-and-practice and compensatory interventions:

“First of all, it is important to consider similarities and differences between our intervention and the one employed by Medalia and colleagues. While both studies addressed problem-solving, our study explicitly focused on planning as a key cognitive function. In the Medalia study, planning was clearly involved in the problem-solving intervention, but a broader set of cognitive functions was likely required, although not explicitly specified. An important issue in the classification of cognitive remediation techniques is the amount of strategy teaching involved [56]. In both studies, participants in the problem-solving group were actively supported in the use of efficient problem-solving strategies. In contrast, strategies for compensating existing cognitive deficits were not explicitly trained in either study. Thus, both problem-solving interventions fill the middle ground on a continuum from drill-and-practice to compensatory approaches. Lastly, Medalia and colleagues place a strong emphasis on promoting intrinsic motivation through an engaging task environment and personal feedback. Although this was not the major theoretical background for the development of Plan-A-Day, similar elements can be found in our training task.”