DISCUSSION

This chapter presents the discussion on the findings of the study. The present study describes 1) the adaptation of the Training of Affect Recognition module in the Indian cultural setting 2) assessment of the feasibility of using this intervention module in our patient population and 3) examining the efficacy of this intervention in improving facial emotion recognition abilities in persons with schizophrenia.

The discussions on the findings of the present study with reference to the findings of the other similar studies are organized under the following headings:

5.1 Training of Affect Recognition training module

5.2 Adaptation of the Training of Affect Recognition module in the Indian cultural Setting:
5.3 Pilot study

5.4 Efficacy study on Training of Affect Recognition-Indian Version

5.4.1 Characteristics of study subjects:
5.4.2 Study Design
5.4.3 Assessment tools

5.4.3.1 Emotion Recognition:
5.4.3.2 Neurocognition:
5.4.3.3 Social Occupational Functioning
5.4.4 Baseline findings between intervention group and control group

5.5 Effect of TAR-Indian Version on Emotion recognition:

5.5.1 Effect on perception of individual emotions
5.5.2 Effect on perception of intensities of emotions
5.5.3 Gender effect on intervention in emotion recognition

5.5.4 Cultural effects on improvement in emotion recognition

5.6 Effect of Training of Affect Recognition-Indian Version on attention and Working memory

5.7 Effect of Training of Affect Recognition –Indian Version on socio-occupational Functioning.

5.8 Effect of Training of Affect Recognition-Indian Version on psychopathology

5.9 Predictors of change in emotion recognition

5.10 Other findings

5.10.1 Drop outs in current study

5.11 Testing the original hypothesis
5.1 Training of Affect Recognition training module

The Training of Affect Recognition (TAR) module of Frommann et al\textsuperscript{173} was used in this study. It is a twelve - session program typically conducted twice a week for duration of forty five minutes to one hour each. It has been adapted for use in different cultural settings and is available in German, English, Spanish, Norwegian and French versions.

The TAR is similar to other described social cognition intervention programs such as the SCET (Social Cognition Enhancement Training)\textsuperscript{143}, SoCog (Social Cognition)\textsuperscript{140}, USS (Understanding Social Situation) in structure of sessions and techniques employed; Certain advantages of TAR over other social cognition interventions such as the Attention Shaping (AS)\textsuperscript{172} and Facial Affect Recognition(FAR)\textsuperscript{177} are that 1) TAR employs a greater number of facial emotion stimuli (nearly 160 images of facial emotions and 50 images of social situations) 2) The training stimuli and social situations incorporated in the module are akin to real life situations as opposed to some other modules that include comic strips or cartoon videos and 3) The number of sessions in various social cognition intervention modules ranges from 3-40\textsuperscript{143,172,178} whereas TAR has 12 sessions which is practically feasible to administer.

Unlike the MRIGE\textsuperscript{16} (Mind Reading-Interactive Guide to Emotions) the TAR does not have audio stimuli and there is no specific training for identifying emotional prosody. However, in a study by Wolver et al\textsuperscript{153}, training on TAR had demonstrated improvement in prosodic affect recognition. Similarly, studies have established the efficacy of TAR in improving performance on the social cognition domains.\textsuperscript{10,145,153} TAR interventions have been found to have moderate to large effect sizes in improving facial emotion recognition in persons with schizophrenia.\textsuperscript{10,153} TAR has also been shown to improve social functioning in persons with schizophrenia.\textsuperscript{10,153}
5.2 Adaptation of the Training of Affect Recognition module in the Indian Cultural setting

The adaptation of the original TAR involved translations to the vernacular language (Kannada) and modifications of social contexts to suit Indian cultural sensibilities. The Indian version of the TAR program\textsuperscript{173} retained the number of sessions and basic principles of errorless learning, positive reinforcement, feature abstraction, verbalization and self-instructions of original TAR module.

A similar kind of modification have been attempted in another intervention module (Social Cognition Skill Training) in Egyptian study by Gohar et al\textsuperscript{189}, in which some of the social scenarios were removed (the one which not well suited to Egyptian culture) and replaced by similar but familiar social situation images and vignettes in the training program.

The Caucasian faces used to present emotion stimuli are retained in the Indian version. The cultural biases in perception of emotions have been a matter of debate. Ekman and Friesen\textsuperscript{216} described that identification of basic emotions are universal in nature. However some other studies argue for an in group advantage in recognition of emotion belonging to the same culture.\textsuperscript{217–219} A study examining cross cultural variations in emotion recognition in the Indian population found happy, sad and fear expressions to be identified equally and a weak effect for ethnicity on facial stimuli for anger and surprise.\textsuperscript{220} A meta-analysis of cultural specificity of emotion recognition described that emotions are universally recognized at better than chance levels and the cultural differences in response bias are least for posed expressions than spontaneous expressions.\textsuperscript{217,221} A pilot study conducted at KMC Manipal (Dehal & Behere et al – poster presented at MEDICON conference 2013) examined effect of culture on emotion recognition in our population. 25 healthy subjects from local population were presented with an emotion recognition task consisting of 40 emotion stimuli (5 basic emotions – anger, fear, and neutral, happy, sad from 4 ethnicities – Indian, Negroid, mongoloid and Caucasian) and their
performance on emotion recognition accuracy was assessed. There was no significant effect of ethnicity of emotion stimuli on accuracy of emotion recognition. This suggests that subjects from our native population were able to adequately identify the basic emotions irrespective of ethnicity of facial stimuli.

5.3 Pilot study

The aim of the pilot study was to assess the feasibility of administering the Training of Affect Recognition-Indian Version (TAR-IV) in our population. The results of the pilot study showed that the modified version of the TAR was well accepted in our study population and subjects were able to understand the instructions and complete the training program. The training provided on Caucasian emotional stimuli was able to elicit an improvement in emotion recognition abilities as assessed on validated Indian tool and hence demonstrating the cultural validity of the training program.

Based on experiences from the pilot study, modifications were made in task administration keeping in mind the cultural sensibilities of our population. For example, since a majority subjects were not familiar with the use of computers, they were asked to indicate their responses which were then recorded by the therapist.

TAR-Indian Version also incorporated peer group learning, in which a better performer in the group extends his/her support to a slow learner and provides his inputs to the slow learner. It provides an additional opportunity for the subjects to receive peer support, sense of acceptance in the group and human feedback. It also facilitates further discussion on the recognition of emotions. This might help in regaining subjects self confidence in learning new skills.
5.4 Efficacy study on Training of Affect Recognition-Indian Version

5.4.1 Characteristics of study subjects:

Previously reported intervention studies on the TAR have been performed on a sample size of 24-25 subjects.\textsuperscript{10,145,173} In the present study 69 subjects were recruited. For this study, sample size was estimated utilizing effect sizes from previously reported studies on TAR. Though the design did not employ a randomized controlled methodology (discussed below), this study was adequately powered to detect effects of TAR on emotion recognition abilities in the intervention group. As compared to other studies on social cognition intervention (sample size ranging from 14 to 34)\textsuperscript{10,143,153,173,177,189,194,222,223} this study was performed on a relatively larger sample size.

In the sample at baseline the intervention group and control group was matched for gender and other demographic and illness related variables. However the intervention group had significantly higher psychopathology scores and poorer socio-occupational functioning. This may be a reflection of sample selection where many in the intervention group were in a residential care setting and may have had greater psychopathology scores compared to the control group.

In the current study the researcher recruited subjects in the age range of 18-55 years and with a minimum of seven years of education. The cut off age of 55 years was chosen to control for potential confounding effects of age related cognitive decline. Additionally all subjects were screened on the Hindi mental status examination\textsuperscript{201} for adequate cognitive functioning. They were found to score equal or more than 24.
5.4.2 Study Design:

A majority of studies on social cognition intervention reported in literature employ a randomized design. This study employed an open label design as this was an initial exploratory study to assess effect of Training of Affect Recognition (TAR) module in the Indian context.

5.4.3 Assessment tools:

The present study assessments were performed at three time points; at baseline, post intervention at one and half month and follow up assessment at three months. Only a few follow up studies (ranging from one to week to three months) have been reported in the field of social cognition.

5.4.3.1 Emotion Recognition:

Emotion recognition abilities were assessed in the present study using the Tool for Recognition of Emotions in Neuropsychiatric DisorderS (TRENDS). This is a culturally validated tool for assessing facial emotion recognition in Indian subjects. Other reported studies have utilized tools such as Pictures of Facial Affect and Face Emotion Identification Task (FEIT), Vienna Emotion Recognition. TRENDS is a culturally validated tool, used in studies on Indian schizophrenia patients and was considered most appropriate for use in the present study.

5.4.3.2 Neurocognition

A secondary outcome measured in the present study was the effect of the TAR intervention on neurocognition domains of attention and working memory. Studies have reported that, neurocognition and social cognition are related but they share different constructs. Also,
neural underpinnings of neurocognitive and social cognitive abilities suggest semi-independent systems of processing unsocial and social stimuli.\textsuperscript{224,225}

In the current study ‘attention’ ability of the subjects was assessed with a paper and pencil task called Digit Vigilance Test (DVT). Whereas other studies have used computerized attentional performance tests\textsuperscript{10} to examine individuals alertness and vigilance, wherein they were expected to respond quickly and appropriately to a given demand. Further, Trail Making Test (TMT)-part A.\textsuperscript{144,189} had been used in some studies to assess participants’ attention ability.

In the present study we have used verbal N Back test to assess the subject’s verbal working memory ability. Byrne et al\textsuperscript{177} have used a Chinese version of the letter-number sequencing task (LNST) to assess verbal working memory. Gohar et al\textsuperscript{189} used digit span task (digit forward and backward) to examine working memory. Studies on Social Cognitive Skill Training (SCST) programs have used a detailed neurocognitive assessment tool such as MATRICS Consensus Cognitive Battery (MCCB) assess domain of neurocognition including speed of processing, attention and vigilance, working memory, verbal learning, visual learning, reasoning and problem solving.\textsuperscript{144,191} and other studies have used digit symbol substitution test, verbal learning test and Mazes task for the examination of reasoning and problems solving ability in their study participants.\textsuperscript{177,189}

The DVT and verbal N Back test are widely accepted measures of attention and working memory and have been validated for use in Indian population and normative scores are available.
5.4.3.3 Social Occupational Functioning

An additional outcome assessed in the present study was socio-occupational functioning. The SOFS which is a scale validated for use in persons with schizophrenia in India was used. It has been shown to have correlations with emotion recognition performance in our population.63 A number of other studies have assessed the relationship between sociooccupational functioning and social cognition intervention47,80,125,126,129 and focused on the domains of person’s ability to solve common problems in an interpersonal context, initiating a conversation, negotiation and compromise, standing up for one’s rights, physical health and psychological health, social relationship and environmental health.

Similarly a majority of the previous studies in social cognition have used WHO-quality of life, five minutes role play task, Social Occupational Functioning Assessment Scale (SOFAS), Performance based skills assessment-Brief.10,153,194,226

In this study Social occupational functioning scale (SOFS) was used. This scale examines person’s ability to form and maintain social relationships, adaptive living skills, social appropriateness and interpersonal skills. This scale is brief and would take very less time to assess subjects social functioning.

5.4.4 Baseline findings between intervention group and control group

In the present study it was observed that, there was statistically significant baseline difference in digit vigilance test performance between two groups (p<0.02). The control subjects had greater error scores on DVT compared to intervention group. The two groups were also different on socio-occupational functioning with intervention group showing greater impairment. There were no differences in other parameters at baseline
Studies have reported a strong relationship between impaired neurocognition and impaired emotion recognition which further indicates that neurocognitive abilities underpin the ability to accurately recognize facial emotions in others people. But a few studies have reported that improvement in emotion recognition after the training program was independent from basic neurocognitive deficits. Social functioning is known to be associated with emotion recognition deficits. Hence it is not clear if these baseline differences may influence effect of intervention in the groups.

5.5 Effect of TAR-Indian Version on Emotion recognition:

The current study found that the study group participants (intervention group) showed significant improvement in identifying facial emotions when compared with the control group participants. Accounting for attrition, using the Last Observation Carried Forward LOCF (method) the improvement in emotion recognition was still significant with large effect size ($\eta_p^2=0.28$). The effect of TAR on emotion recognition abilities observed in the study population was similar to that reported earlier on the TAR ($d=1.2$). Further, a meta-analytical study by Kurtz et al (included nineteen randomized controlled studies) reported that emotion recognition training programs have moderate to large effects size ($d=0.71$) in improving emotion recognition in persons with schizophrenia.

Similarly, studies on social cognition training programs demonstrated improvements in emotion recognition and managing emotions when compared with control groups but a significant number of studies did not establish such an improvement.

Errors in emotion recognition include discrimination and misidentification errors. People with paranoid subtype of schizophrenia, tend to over identify non-threatening emotions (neutral,
happy, sad) as any of the threatening emotions anger, fear, disgust.\textsuperscript{228} Persons with schizophrenia in remission phase or with residual symptoms show under-identification errors.\textsuperscript{57} In the present study, we found that in addition to improved accuracy scores on emotion recognition there was also a significant decrease in under-identification errors with effect size of 0.22. There was no change noticed in the participants’ over-identification of the facial emotions.

A study by Behere et al\textsuperscript{57} reported that persons with schizophrenia (those who were experiencing first rank symptoms) or those who were experiencing heightened sense of paranoia significantly over identify non-threatening emotion as threat emotions. On the other hand, those who were with lesser first rank symptoms shown greater errors in emotion under-identification.

This study examined the stability of the gains in emotion recognition abilities after two months of the intervention. It was found that, participants in the intervention group maintained their improvement in emotion recognition in their two months of follow up (p<0.001). Although, there was a trend towards decrease in emotion recognition mean scores during follow up assessment.

A follow up study by Luckhaus et al\textsuperscript{229} reported that, study group subjects were able to show significant improvement in facial emotion recognition after the Training of Affect Recognition (TAR) program and this improvement was maintained during two months of follow up. Similarly, other studies have examined stability of emotion recognition over one week to six month.\textsuperscript{183,187,194,230} However, there has been a trend towards decrease in emotion recognition score during follow up assessment when compared with post assessment. But, this decrease from post-test to follow up was relatively small differences ranged between five to thirteen percent of post test score.\textsuperscript{183,187,230} A study by Hodel et al\textsuperscript{231} reported that, they did not find any
difference in emotion recognition abilities during the four months of follow up when it compared with baseline assessments.

In the present study, as in many other previous studies on emotion recognition training program were conducted on persons with schizophrenia with better response to antipsychotic treatments or with patients partly remitted from schizophrenia.\textsuperscript{10,142–144,153,189} Therefore, there is a need for studies to examine results in persons with resistant schizophrenia. Also, there is a need for longer duration follow up studies (six months to one year) on social cognition interventions to make a meaningful observation on improvement in emotion recognition abilities.

5.5.1 Effect on perception of individual emotions:

People with Schizophrenia are known to demonstrate specific deficits in recognition of negative emotions (anger, fear, disgust) as compared to positive emotions. Deficits in recognition of these ‘threat’ related emotions play a vital role in attributing emotional salience to environmental cues and may contribute to psychopathology and poorer socio-occupational functioning.\textsuperscript{57,228}

In this study, there was specific improvement in the recognition of disgust and fear emotions while there was no change in the recognition of positive emotions (happy) and neutral. The improvement in negative emotions indicates a specific effect of TAR on threat related emotions. This is further supported by the observation of reduction in under identification errors. A study by Sachs et al\textsuperscript{10} on Training of Affect Recognition (TAR) found a more generalized effect with significant improvement in recognition of positive emotion of happy, as well as negative emotions - sad, fear and anger. Similarly, Facial Emotion Recognition (FAR)\textsuperscript{177}, Attentional shaping\textsuperscript{232}, Emotion and ToM Imitation Training (ETIT)\textsuperscript{150} programs have shown improvement in recognition of fearful, anger, disgust and sad emotions in their study participants.\textsuperscript{17,150,177,183}
5.5.2 Effect on perception of intensities of emotions:

Kohler et al\textsuperscript{52} reported that persons with schizophrenia did not identify high intensity emotions accurately when compared with low intensity emotions. Hence more intense expressions of emotions may not lead to better recognition and may lead to misattribution to other emotions. This deficit was more for fearful emotions as compared to other emotions.

The present study found significant improvement in identification of both low as well as high intensity emotions in study group participants, even though they had poorer social functioning and more negative symptoms. Marsh et al\textsuperscript{187} reported a greater improvement in high intensity emotional stimuli and lower scores in attention, poorer social functioning and anhedonia might have influenced identification of lower intensity emotions.

5.5.3 Gender effect on intervention in emotion recognition:

Studies have shown that in healthy control subjects, females consistently perform better than healthy males on facial affect recognition but this particular advantage seems to be lost in people with schizophrenia.\textsuperscript{181} In this study males and females were represented equally in both groups. The investigator examined the effect of gender of subject and found that both males and females performed equally in our TAR program.

Marsh et al\textsuperscript{233} reported gender differences in attention to facial features after social cognition intervention with females subjects showing significantly increased attention to the mouth of disgusted faces and decreased attention to the eyes of surprised and sad faces when compared with male participants. Hence while men and women may benefit equally with social cognition intervention and they employ different strategies while processing emotional stimuli.
5.5.4 Cultural effects on improvement in emotion recognition

Cultural biases in perceptions of emotions have been a matter of debate. Ekman and Friesen \(^{216}\) described that identification of basic emotions are universal in nature. However, some other studies argue for an in group advantage in recognition of emotion belonging to the same culture. \(^{221,234}\) In the present study the training for feature detection provided on Caucasian facial stimuli was able to bring about a significant change in emotion recognition abilities as assessed on a task with Indian facial stimuli. The finding of the present study supports the initial observation made in the pilot study and provides further support to the theory of universality of basic emotions.

5.6 Effect of Training of Affect Recognition-Indian Version on attention and working memory:

A significant improvement in performance on DVT and verbal N back errors was observed in the control group. The control group at baseline had lower scores on DVT which possibly showed a change with treatment as usual. However, this was not significant on ANOVA or LOCF analysis. There was no effect of intervention on neurocognitive scores in the intervention group.

Contradicting the present study finding, Veltro et al\(^{17}\) reported a time effect on selective attention measure (Trail making test) in social cognition training program (Cognitive Emotional Rehabilitation) as well as in control group (received problem solving training program). Similarly, Mazza et al\(^{150}\) found that selective attention increased in both the study group (Emotion and Theory of Mind Imitation Training) as well as in the control group (Problem Solving Skill Training) but there was no improvement noticed in the area of sustained attention. Horan et al\(^{144,191}\) reported that both the study group and the control group had shown significant
time effect in the total scores of MATRICS (Measurement and Treatment Research to Improve Cognition in Schizophrenia).

A study by Sachs et al\textsuperscript{10} did not find any improvement in participants working memory after the original TAR training program. Whereas Wolwer et al\textsuperscript{169} reported that, their study participants performed better on the working memory task (examined through digit span test) after receiving TAR intervention program. Subjects (who had received Cognitive Remediation Training) showed large improvement in the learning and memory task (assessed by the AVLT) than Training of Affect Recognition and Treatment As Usual (TAU) group. These earlier reported studies on TAR along with the present study findings suggest that the TAR does not have a significant effect on improving neurocognition. Overall, cognitive remediation programs can improve neurocognitive abilities in persons with schizophrenia but they may not improve social cognition abilities. Social cognition intervention programs such as TAR can be used as an adjuvant to conventional cognitive remediation strategies to additionally target social-cognitive abilities.

5.7 Effect of Training of Affect Recognition – Indian Version on socio-occupational functioning:

Socio-occupational functioning is an important indicator of outcome in schizophrenia and closely linked to social cognition abilities.

In the current study, the intervention group was found to have significant improvement in their adaptive living skills and in total socio occupational functioning score after intervention. On repeated measures ANOVA, there was a significant improvement on domain of Interpersonal skills from baseline to follow up in intervention group and this effect remained significant on LOCF analysis. No significant change in socio-occupational functioning was observed in the
control group. Though the intervention group was at a lower functioning level at baseline compared to controls, this group showed a significantly greater improvement in functioning after intervention suggesting a specific effect of TAR on improving functioning in schizophrenia. The benefit of intervention also persisted on follow up and intervention group continued to improve in functioning levels.

On Pearson correlation post intervention, improvement in emotion recognition (TRACS) did not show any association with social occupational functioning \((r=0.05, \ p= 0.73)\). Also, there was no significant correlation between change in emotion under-identification and change in SOFS \((r=0.06, \ p=0.72)\).

A study by Wolwer and Frommann\textsuperscript{153} reported that neither the social cognitive measures (facial emotion recognition, prosodic affect recognition, theory of mind) nor the participants psychopathology was significantly associated with functioning as assessed on SOFAS (Social and Occupational Functioning Assessment Scale). However, social competence (assessed on role play task) correlated with facial affect recognition and was found to be a significant predictor of the social functioning. Similarly Horan et al\textsuperscript{191} did not find any significant association in functional outcome in their study group. Mazza et al\textsuperscript{235} on Emotion and Theory of Mind Imitation Training (ETIT) reported significant improvement in subjects social functioning which was assessed by personal and social performance scale (PSP). A study by Sachs et al\textsuperscript{110} reported improved subjective quality of life especially in social relationship in training of affect recognition group.

Social cognition intervention independently improves emotion recognition abilities as well as socio-occupational functioning.\textsuperscript{236} However, studies in literature as well as the present study findings have not demonstrated a consistent association between change in functioning and
improvement in social cognition abilities. Social functioning is possibly a complex construct that is influenced by a number of factors. For example, a study by Bhagyavathi et al\textsuperscript{237} reported that social cognition influences functionality through motivation, negative symptoms (such as apathy, alogia and anhedonia) and insight in persons with schizophrenia. It is possible that social cognition interventions may bring about changes in higher order social cognition domains along with emotion perception which may mediate the improvement in functioning. A study by Brown et al\textsuperscript{125} reported that a more sophisticated level of TOM or mental state reasoning appears to be associated with real life functioning than emotion perception. Penn et al\textsuperscript{214} reported that TOM and higher order mentalizing skills (meta cognition) as well as other domains of social cognition are necessary for the improvement in social functioning in persons with schizophrenia. Current instruments for measuring functioning may not tap into real world functioning outcomes that may be actually impacted by social cognition interventions. Further studies which assess higher order social cognition domains along with assessment of real world functional outcomes may be necessary to understand the relationship between functioning and social cognitive abilities. It would also be important to understand whether the benefits of social cognition intervention program on functioning are stable over long term follow up.

5.8 Effect of Training of Affect Recognition-Indian Version on psychopathology:

The current study could not show any effectiveness in improving patient’s psychopathology over control group (TAU). Studies examining effect of social cognition intervention on psychopathology have shown mixed findings. Roberts et al\textsuperscript{194} reported advantage for SCIT (Social Cognition Interaction Training) over treatment as usual (TAU) group in improving negative symptoms. However, a meta-analysis by Kurtz and Richardson\textsuperscript{180} reported that social
cognition intervention programs failed to show any particular influence on positive and negative symptoms in persons with schizophrenia.

5.9 Predictors of change in emotion recognition:

In the present study, a linear regression analysis revealed that age of onset negatively predicts recognition of facial emotions significantly. It indicates that participants with a younger age of onset benefitted from the emotion recognition training program. It could be because they might have had greater deficits in facial emotion recognition. Also it was noticed that, this study participants’ in intervention group had developed their illness at the age of 23.11 (7.30) years and this is usually the age of occupying oneself in some kind of job and having relationship with opposite gender. But in this study participants’ had higher rates of unemployment and majority of them were unmarried and had longer duration of illness (17.80±9.35). Possibly these factors contributed to withdrawal from social interaction, which makes them less socially interactive and this further might lead to poor social and occupational skills. Hence, this study participants might have had significant impairment in their facial emotion recognition and in other domains of social cognition which were not assessed in the current study. However contrary to this finding, a study by Walker et al did report that early onset patients do not differ from late onset patients in the pattern of impairment in emotion recognition.

This study found that working memory test on one back hits negatively predicts (significantly) predicts recognition of facial emotions. It indicates that, persons with poor working memory abilities would perform better in emotion recognition test after the emotion recognition training program. Probably this could be because; people with good working memory were already using other compensatory strategies to perform in emotion recognition test (TRENDS), whereas these strategies are not available for people with lower working memory.
Hence it may be possible that intervention on TAR-Indian Version was more beneficial for people with lower working memory abilities.

The literature review yields mixed findings on the association between working memory and emotion recognition. A study by Addington et al\(^4\) reports that persons with schizophrenia might require a better neurocognitive abilities (especially working memory) to identify facial emotions correctly. A few other studies have reported that impairment in working memory had strong association with poor emotion recognition abilities in person with schizophrenia.\(^{187,239,240}\) These findings suggest the importance of working memory in the improvement of emotion recognition abilities in persons with schizophrenia. However Wolwer et al\(^{169}\) observed that attention and comprehension abilities were found to be significant predictors of better performance in facial affect recognition and none of the other basic cognitive abilities showed significant relationship with emotion recognition in persons with schizophrenia. In contrast, Horan et al\(^{144}\) reports that improvement in emotion recognition ability was independent from subject’s baseline neurocognitive impairments.

However, it must be noted that verbal one back hit is more a measure of recent memory rather than working memory. The former is relatively intact in schizophrenia hence the use of verbal one back test to assess working memory may have had limitations.

Findings from this study suggests that having better neurocognitive abilities may provide an advantage in obtaining benefit from emotion recognition training programs. It is important to note that emotion recognition training program like TAR-Indian version place less demands on the subjects working memory abilities.
A study by Marsh et al\textsuperscript{187} reports that, higher level of baseline social functioning and less clinical symptoms play a major role in benefitting from emotion recognition training. Contradictory to this, our study participants had more impairment in social occupational functioning and had more psychopathology than control group participants but social functioning did not predict changes in emotion recognition abilities. A linear regression analysis in the current study revealed that improvement or changes in emotion recognition abilities in intervention group was not related to improvement in psychopathology and social occupational functioning in intervention group. This may be because facial emotion recognition deficits in persons with schizophrenia are specific deficits unlinked to other domains.\textsuperscript{169}

Also, studies examining the neural underpinnings of neurocognitive and social cognition abilities suggest semi-independent systems of processing non-social and social stimuli.\textsuperscript{224}

5.10 Other findings

5.10.1 Drop outs in current study

In the present study, the researcher observed dropout rate of 20.00\% in the study group and 32.55\% in the control group. On follow up assessment the dropout rate was 36.11\% in study group and 20.68\% in control group.

Reasons for dropout in an intervention group of this nature include loss of motivation to remain in the program over an extended period of time and relapse of symptoms. Among the 20\% of dropouts in study group (during baseline to post intervention assessment), 18\% of the dropouts occurred because of the loss of interest in training program and this dropout occurred during the first four sessions of the therapy. Later, 2\% of the dropout occurred during the sixth session because of relapse. This is comparable to previously reported studies on the TAR, where an
dropout rate of 24% was observed.\textsuperscript{153,195} Studies have noted that having long term interventions like 36 sessions, 30 sessions or 20 sessions for four to six months could be one of the reasons for dropout from studies.\textsuperscript{98,143}

A possible measure for preventing dropout is the active involvement of the family members in any training program. Family members tended to accompany their wards during the training program in this study. This may be a useful technique to improve adherence to intervention in future studies.

With comparison to intervention group, control group had a greater dropout rate in our study. The control group was receiving treatment as usual and sham intervention was not part of this protocol. The lack of engagement with a therapist might explain the greater dropout rates in the controls.

\textbf{5.11 Testing the original hypothesis}

On the basis of the findings obtained from the study, the tenability of our hypothesis is presented below:

\textbf{Hypothesis 1}

\textbf{The study group receiving intervention on the TAR-Indian Version module will show significant improvement in facial emotion recognition abilities compared to control group.}

In the current study, TAR-Indian version was found to have large effect size in enhancing facial emotion recognition abilities in intervention group when compared with control group confirming hypothesis 1.
Hypothesis 2

There will be improvement in performance on tasks of attention, working memory and socio-occupational functioning after training in intervention group as compared to control group.

TAR-Indian Version did not find Improvement in performance on tasks of attention and working memory. There was improvement in adaptive living skills, interpersonal skills and in total social-occupational functioning score after TAR-Indian Version when compared with control group. This hypothesis was partially supported by the study findings.

Hypothesis 3

The improvement in emotion recognition abilities will be associated with improvement in attention, working memory tasks and improvement in social-occupational functioning in the intervention group.

In the current study, Training of Affect Recognition-Indian version did not find significant correlation between change in emotion recognition and change in social occupational functioning, attention and working memory. Hence, study findings did not support this hypothesis.