

Clinical and Functional Outcomes of At-Risk Mental State Among Non-Help Seeking Adolescents

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Abstract

Background: At-risk mental state (ARMS) individuals are at high risk to develop psychosis. In addition to attenuated symptoms, ARMS is associated with cognitive and functional impairment. The findings are mostly based on research in help-seeking at-risk population. Our study aim was to explore prevalence rates of ARMS, comorbidities, functioning, and cognitive performance among non-help seeking adolescents.

Patients and methods: Study subjects were randomly selected high school adolescents. At-risk mental state was assessed with Comprehensive Assessment of At Risk Mental States interview (CAARMS). Kiddie-Schedule for Affective Disorders and Schizophrenia examined comorbidities. Social functioning and quality of life were measured with Social and Occupational Functioning Assessment Scale (SOFAS) and KIDSCREEN 52. Cognitive performance in the domains of visual memory, verbal memory, working memory, and processing speed was assessed with a battery of cognitive tests

Results: The total of 82 adolescents was enrolled, 21 of them met the ARMS criteria. No case of threshold psychotic disorder was detected in the study sample. Subthreshold mental disorders were more frequent in the ARMS+ group than in the ARMS- group (OR= 3.05; 95%CI 1.07, 8.67; p=0.03). Lower SOFAS scores were observed in the ARMS+ group compared to the ARMS- group (t= -3.888; p<.001; Cohen's d = 0.99). In the total sample, CAARMS symptoms intensity was negatively associated with the SOFAS score ($\beta = -.51$; $R^2 = 0.26$; p<.001). No significant differences in the KIDSCREEN-52 scores or cognitive functioning were found between the groups.

Conclusion: Our findings suggest that non-help seeking adolescents with at-risk mental state have worse level of functioning compared to controls and higher rates of non-psychotic psychiatric comorbidities. Reduction in functioning is negatively associated with the severity of their subsyndromal psychotic symptoms.

Background

Early intervention studies in psychosis typically focus on prodromal phase of illness, characterized primarily by the presence of attenuated symptoms [1, 2]. Individuals who meet At Risk Mental State (ARMS) criteria have five times higher chance to be diagnosed with psychotic disorder or schizophrenia [3, 4]. Since the ARMS was developed for a population of help-seeking individuals, the data on prevalence of the ARMS status in general population are rather scarce [5]. A recent systematic review of nine studies with non-help seeking individuals indicated ARMS prevalence of 1 to 8%, depending on the questionnaire used [6].

One of the most consistent findings in ARMS research is cognitive impairment [7, 8]. Deficits in general intelligence, attention, executive functions, verbal fluency, working memory, and verbal and visual memory domains, but no impairment in processing speed, were confirmed in a meta-analysis of 1188 ARMS subjects and 1029 controls [9]. These results are consistent with those reported in schizophrenia patients

[10]. Thus, cognitive impairment can be considered as one of the strongest factors predicting the risk of transition to psychosis [11].

Cognitive impairment correlates with a decline in social and occupational performance measured by the Social and Occupational Functioning Assessment Scale (SOFAS) not only in patients diagnosed with schizophrenia, but also in the ARMS subjects [12]. Deficit in social cognition of the ARMS subjects was found to be associated with low level of overall functioning and poor social skills [13, 14]. Furthermore, a meta-analysis revealed that the functional level of ARMS individuals is closer to that observed in people with psychosis than in healthy individuals [15].

One of the few studies with non-help seeking subjects showed that compared to healthy controls, the ARMS subjects recruited from community had impaired cognition, poorer social functioning, and lower Global Assessment of Functioning score [16]. The profile of their cognitive deficit was similar to the cognitive pattern of their help-seeking counterparts.

The aim of our study was to examine the prevalence of ARMS among non-help seeking adolescent population and to investigate its relationship to cognition, quality of life, and functioning. We hypothesized that non-help seeking ARMS adolescents would have more psychiatric diagnoses, lower level of functioning and quality of life (QoL), and poorer cognitive performance, as compared to non-ARMS adolescents. Further, the severity of ARMS symptoms would be negatively associated with general functioning, QoL, and cognitive performance.

Material And Methods

Study subjects

This was a cross-sectional study. Participating schools were identified through the publicly available registry of high schools in the administrative districts of Prague and Central Bohemia. In total, during 2018 and 2019, 82 high schools were approached, out of which 14 ($n = 14/82$; 17%) agreed to participate in the project. Study participants were recruited through a two-phase process. The first phase (Phase 1) took place at high-schools and consisted of an educational lecture for students delivered by a study psychiatrist and initial screening for at risk symptoms with Prodromal Questionnaire-Brief version [17]. A subset of adolescents from Phase 1 with positive and negative Prodromal Questionnaire-Brief version screening (allocation 1:1) was randomly selected, invited into the second phase (Phase 2) and fully assessed (Fig. 1). Methods and primary results of the Phase 1 study are described in detail elsewhere [18]. In the present study, we report the results of the Phase 2 study.

Study protocol was approved by the Ethical Committee of the National Institute of Mental Health, Klecany, Czech Republic. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and other applicable laws and regulations. All participants older than 18 years provided written informed consent, for participants younger than 18 years the consent was obtained from their parents/legal representatives.

Study Assessments

Clinical characteristics

Basic demographic data (age, sex) were recorded. The Comprehensive Assessment of At Risk Mental States (CAARMS) interview was used to determine the following ARMS criteria across all study subjects: 1) attenuated psychotic symptoms (APS), this criterion identifies young people at risk of psychosis due to the subthreshold psychotic syndrome; 2) brief limited intermittent psychotic symptoms (BLIPS), this criterion identifies young people at risk of psychosis due to a recent history of frank psychotic symptoms that resolved spontaneously; and 3) vulnerability group, this criterion identifies young people at risk of psychosis due to the combination of a trait risk factor and a significant deterioration in psychosocial functioning [19]. The CAARMS assesses the frequency and intensity of psychopathology, including unusual thought content, non-bizarre ideas, perceptual abnormalities, and disorganized speech. The CAARMS retains high sensitivity (0.87) for prediction of the onset of psychosis [3].

The Kiddie-Schedule for Affective Disorders and Schizophrenia (K-SADS) was used to obtain the full profile of current mental disorders. Presence of both threshold and subthreshold mental disorders was examined [20]. Subthreshold mental disorder is defined by the K-SADS as a presence of symptoms of mental disorder not fulfilling the criteria for intensity and frequency of threshold mental disorder.

Social functioning and QoL

The Social and Occupational Functioning Assessment Scale (SOFAS) was administered to evaluate the current level of social and occupational functioning. The SOFAS is a global rating of current functioning, a score within a range of 0 to 100, with lower values representing poorer functioning [21].

All subjects were evaluated with the KIDSCREEN-52, a self-report instrument based on the definition of QoL as a multidimensional construct, covering subjectively perceived physical, emotional, mental, social, and behavioral components of well-being and functioning. The KIDSCREEN-52 has been validated for the Czech general adolescent population [22].

Cognitive functioning

Cognition was examined with a battery of tests measuring the following domains:

Visual Memory. The Rey complex figure test and recognition trial was administered (RCFT). The figure was placed in front of the participants, who were requested to copy the figure as accurately as possible. The immediate recall (3 minutes) and delayed recall (30 minutes) reproductions were scored for the accuracy and placement of 18 specific design elements [23].

Verbal Memory. The Rey auditory verbal learning test (RAVLT). A 15 noun-word list (list A) was read to the participants with a presentation rate of one word per second. After presentation of 15 words the participants were requested to recall as many words as possible. The procedure was repeated 5 times.

The 5 recall trials were summed into a single score (trial 1–5). Delayed recall was obtained after 30 minutes [24]. The Logical memory subtest of the Wechsler Memory Scale (WMS-LM). The immediate recall (3 minutes) and delayed recall (30 minutes) scores were recorded [25].

Processing speed. Trail Making Test part A (TMT A). Part A requires the participant to connect series of numbered circles arrayed randomly on a sheet of paper using a pencil. The scoring is expressed as time to completion [26]. The Digit Symbol coding test (DS) from the Wechsler Memory Scale – Third Edition. This task consists of rows containing small blank squares, each paired with a randomly assigned number from one to nine. Above these rows is a printed key that pairs each number with a different symbol [27].

Working memory. Trail Making Test part B (TMT B). Part B requires the participant to connect series of both numbered circles and letters arrayed randomly on a sheet of paper using a pencil. The scoring is expressed as time to completion [26]. The Spatial Span test from the Wechsler Memory Scale – Third Edition (WMS-III). This test consists of a board with ten spatially distributed cubes mounted on top of it. The examiner taps block sequences of increasing length that have to be repeated in the same (forward) or reverse (backward) order. The combined score was recorded [27].

Statistical Analyses

Descriptive statistics were used to assess socio-demographic characteristics of the sample. We calculated prevalence rates of mental disorders diagnosed by K-SADS. The scores of SOFAS, KIDSCREEN-52, and cognitive tests were expressed as the mean values with standard deviations (SD). The distribution of each variable was tested by the degree of skewness and kurtosis [28]. Unpaired t-tests, Pearson Chi-square tests, and Mann-Whitney U tests were used to assess the differences in current mental disorders, functioning, QoL, and cognitive performance between adolescents at risk mental state positive (ARMS+) and adolescents at risk mental state negative (ARMS-). Statistical significance for all tests was set at $p < .05$. Standardized effect size for each intergroup difference was calculated as Cohen's d . To analyze associations of CAARMS symptoms severity with functioning, QoL, and cognitive performance in the total sample, we calculated the CAARMS symptoms severity scale as a sum of frequency of unusual thought content, non-bizarre ideas, perceptual abnormalities, and disorganized speech. Then we fitted a multivariate linear regression model to test the effect of CAARMS symptoms severity and the presence of threshold or subthreshold mental disorder on functioning, QoL, and cognitive impairment. Results of a linear regression model were expressed as standardized beta coefficients (β). Quality of model fit was assessed using the adjusted coefficient of determination (R^2). Analyses were conducted in the SPSS software package, version 23.0.

Results

Demographics and clinical characteristics

The total of 82 adolescents was enrolled into the study. Twenty-one participants met the ARMS attenuated psychotic symptoms criteria (ARMS+), no case with brief limited intermittent psychotic symptoms nor with the vulnerability traits was detected in the study sample. The ARMS + group and the ARMS- group (n = 61) did not differ in gender (females: 16/21 vs. 36/61; $X^2 = 1.986$; $p = .2$) and age (mean: 17.5, SD = 0.7 years vs. 17.4, SD = 0.9 years; $t = 0.483$; $p = .7$).

The ARMS + and ARMS- groups did not differ in the occurrence of major depressive disorder (0/21 vs. 2/61 cases; $X^2 = 0.706$; $p = .4$), anxiety disorders (4/21 vs. 6/61 cases; $X^2 = 1.238$; $p = .3$), or substance use disorders (3/21 vs. 2/61 cases; $X^2 = 3.306$; $p = .07$). No case of threshold psychotic disorder was found in the study sample. Subthreshold mental disorders were more frequent in the ARMS + group than in the ARMS- group (10/21 vs 14/61 cases; $X^2 = 4.592$; OR = 3.05; 95%CI 1.07, 8.67; $p = .03$). For details, see Table 1.

Table 1
Clinical characteristics of study sample.

	ARMS_AP+ N = 21	ARMS_AP- N = 61	p*
Any current threshold mental disorder, n (%)	6 (28.6)	11 (18.0)	.3
Major depressive disorder	0 (0)	2 (3.3)	.4
Anxiety spectrum ^A	4 (19.0)	6 (9.8)	.3
Psychotic spectrum	0 (0)	0 (0)	1.0
ADHD	1 (1.6)	1 (4.8)	.4
Substance abuse ^B	3 (14.3)	2 (3.3)	.07
Others ^C	0 (0)	0 (0)	1.0
Any current subthreshold mental disorder	10 (47.6)	14 (23.0)	.03
Major depressive disorder	1 (4.8)	2 (3.3)	.8
Anxiety spectrum ^A	6 (28.6)	12 (19.7)	.4
ADHD	1 (4.8)	1 (1.6)	.4
Others ^C	2 (9.5)	1 (1.6)	.1
<p>Abbreviations: ARMS, At Risk Mental State; AP+, Attenuated Psychosis positive; AP-, Attenuated Psychosis negative; ADHD, <i>Attention Deficit Hyperactivity Disorder</i>.</p> <p>Notes:</p> <p>* Pearson Chi-Square</p> <p>^A including panic disorder, simple phobia, agoraphobia, generalized anxiety disorder, and adjustment disorder</p> <p>^B including alcohol and cannabinoids</p> <p>^C including obsessive-compulsive disorder, eating disorders, behavioral disorders, autistic spectrum disorders, posttraumatic stress disorder</p>			

Social functioning and QoL

Significantly lower mean SOFAS scores were observed in the ARMS + group than in the ARMS- group ($t = -3.888$; $p < .001$; Cohen's $d = 0.99$). No statistically significant differences in the mean KIDSCREEN-52 scores were found between the ARMS + and ARMS- groups. For details, see Table 2.

Table 2
SOFAS and KIDSCREEN-52 domains scores.

	ARMS_AP+ N = 21	ARMS_AP- N = 61	p*	Cohen's d
SOFAS mean (SD)	70.8 (12.3)	80.9 (9.4)	< .001	0.99
KIDSCREEN-52 ^A mean (SD)				
Physical Well-being	43.3 (12.2)	48.9 (13.1)	.09	0.43
Psychological Well-being	41.4 (8.1)	44.2 (8.1)	.2	0.35
Moods and Emotions	41.9 (7.5)	44.7 (7.3)	.1	0.38
Self-Perception	42.4 (11.4)	45.3 (6.8)	.2	0.35
Autonomy	47.2 (7.9)	46.4 (8.1)	.7	0.10
Parent and Home Life	42.9 (8.4)	44.7 (8.8)	.4	0.21
Financial Resources	52.7 (8.0)	54.3 (8.7)	.5	0.19
Social Support and Peers	46.8 (10.8)	45.4 (8.0)	.5	0.16
School Environment	43.9 (7.2)	45.3 (6.4)	.4	0.21
Social Acceptance (Bullying)	48.0 (10.3)	50.0 (7.6)	.3	0.24
Abbreviations: ARMS, At Risk Mental State; AP+, Attenuated Psychosis positive; AP-, Attenuated Psychosis negative; SOFAS, Social and Occupational Functioning Assessment Scale.				
Notes:				
* unpaired t-test				
^A T-scores according to the Czech general adolescent population data				

Associations between CAARMS symptoms intensity and functioning and QoL in the total sample.

For the whole study sample, there was a significant negative association between the CAARMS symptoms intensity and SOFAS score ($\beta = -.51$; $R^2 = 0.26$; $p < .001$). In the regression model with CAARMS symptoms subscales ($R^2 = 0.23$, $F [4, 77] = 6.987$, $p < .001$), only non-bizarre ideas ($\beta = -.25$; $p = .03$), and disorganized speech ($\beta = -.23$; $p = .04$) were significantly associated with the SOFAS score. No

statistically significant relationship with the presence of current K-SADS threshold/subthreshold diagnoses was found.

CAARMS symptoms intensity was associated with Physical Well-being ($R^2 = 0.11$, $F [3, 78] = 4.383$, $p = .007$), Psychological Well-being ($R^2 = 0.13$, $F [3, 78] = 5.088$, $p = .003$), Moods and Emotions ($R^2 = 0.17$, $F [3, 78] = 6.461$, $p = .001$), Self-Perception ($R^2 = 0.13$, $F [3, 78] = 5.124$, $p = .003$), and Parent and Home Life ($R^2 = 0.08$, $F [3, 78] = 3.228$, $p = .03$). No other significant associations of respondents' clinical characteristics and KIDSCREEN52 domains were detected. For details, see Table 3.

Table 3

Significant associations of respondents' clinical characteristics with the QoL domains.

Physical Well-being	β	p
CAARMS symptoms intensity	-0.28	.01
Presence of current threshold diagnosis	-0.23	.04
Presence of subthreshold diagnosis	0.02	.9
$R^2 = 0.11; p = .007$		
Psychological Well-being	β	p
CAARMS symptoms intensity	-0.30	.005
Presence of current threshold diagnosis	-0.11	.3
Presence of subthreshold diagnosis	-0.21	.05
$R^2 = 0.13; p = .003$		
Moods and Emotions	β	p
CAARMS symptoms intensity	-0.41	< .001
Presence of current threshold diagnosis	-0.04	.7
Presence of subthreshold diagnosis	-0.12	.3
$R^2 = 0.17; p = .001$		
Self-Perception		
CAARMS symptoms intensity	-0.30	.006
Presence of current threshold diagnosis	-0.23	.03
Presence of subthreshold diagnosis	-0.07	.5
$R^2 = 0.13; p = .003$		
Parent and Home Life		
CAARMS symptoms intensity	-0.22	.047
Presence of current threshold diagnosis	-0.21	.06
Presence of subthreshold diagnosis	-0.08	.4
$R^2 = 0.08; p = .03$		
Abbreviations: CAARMS, The Comprehensive Assessment of At Risk Mental States.		

Cognitive functioning

No statistically significant differences in visual memory, verbal memory, processing speed, or working memory were found between the ARMS + and ARMS- groups. For details, see Table 4. Analysis of the total sample did not yield any significant associations between CAARMS symptoms intensity, presence of threshold or subthreshold mental disorder and cognitive performance.

Table 4
Cognitive functioning.

	ARMS_AP+ N = 21	ARMS_AP- N = 58	p	Cohen's d
Visual Memory				
CFT 3	22.1 (7.2)	21.2 (6.6)	.6 ^A	0.13
CFT 30	21.7 (6.9)	21.1 (6.8)	.7 ^A	0.09
Verbal Memory				
AVLT I-V	55.4 (6.9)	53.6 (7.9)	.4 ^A	0.23
AVLT 30	12.0 (2.2)	11.6 (2.7)	.5 ^A	0.16
WMS LogM	47.3 (7.8)	48.3 (8.9)	.6 ^A	0.12
WMS LogM 30	30.2 (5.0)	31.5 (7.5)	.5 ^A	0.19
Processing Speed				
TMT A	25.9 (8.5)	29.6 (10.6)	.1 ^A	0.37
WAIS SymbCode	83.4 (12.8)	81.7 (13.8)	.6 ^A	0.13
Working Memory				
TMT B	62.8 (21.3)	64.6 (28.8)	.8 ^B	0.07
WMS Spatial span	17.8 (3.2)	17.8 (3.1)	1.0 ^A	0.00
<p>Abbreviations: ARMS, At Risk Mental State; AP+, Attenuated Psychosis positive; AP-, Attenuated Psychosis negative; CFT, Complex Figure Test; AVLT, Auditory Verbal Learning Test; WMS, Wechsler Memory Scale; TMT, Trail Making Test; WAIS, Wechsler Adult Intelligence Scale.</p> <p>Notes: ^A unpaired t-test; ^B Mann-Whitney U test</p>				

Discussion

The objective of the study was to examine clinical, functional, and cognitive outcomes of at-risk mental state among Czech non-help seeking adolescents drawn from general population. The results revealed lower social and occupational functioning, and higher prevalence of subthreshold mental disorders in the ARMS + adolescents compared to the controls. Our findings thus confirm the hypothesis that even the non-help seeking ARMS + adolescents have more psychiatric diagnoses and lower level of functioning. Furthermore, a significant association was found between the presence of subthreshold psychotic syndrome and quality of life among non-help seeking adolescents; the severity of CAARMS symptoms was negatively associated with general functioning. However, the presumption of poorer cognitive performance in ARMS + subjects could not be confirmed.

The prevalence of ARMS + adolescents in our sample (26%) was higher than previously reported [6, 29]. It can be attributed to the sampling bias, subjects with subtle symptoms are more prone to participate in testing. Since there were no adolescents with threshold psychosis detected in our sample, it is possible that some subjects developed psychosis after initial screening and subsequently refused to participate in the study phase two. Nevertheless, there are no data to support this surmise.

Two other studies reported high rates of comorbidities among the ARMS + samples, mainly with mood and anxiety disorders [14, 30]. However, both studies included help-seeking individuals only. In a study with non-help-seeking adolescents, 63% of those who met criteria for a prodromal risk syndrome also met criteria for at least one lifetime Axis-1 diagnosis [31]. In our non-help-seeking sample, the prevalence of other psychiatric disorders was lower. Interestingly, even the difference in the prevalence rates of threshold mental disorders between ARMS+/ARMS- subjects did not reach statistical significance. On the other hand, we should not overlook the high prevalence of subthreshold diagnoses in our ARMS + sample, similar to the prevalence observed in larger samples [32]. The subthreshold mental disorders were more frequent in the ARMS + group than in the ARMS- group. Since subthreshold anxiety and affective disorders have been found to precede full blown non-psychotic illness, these data emphasize the importance of clinical follow-up of the ARMS + adolescents [33–34].

Overall level of functioning, as indexed by the SOFAS score, were similar to the functioning level of non-help-seeking adolescent samples from other countries [29, 35]. The SOFAS score in our sample was mostly affected by the severity of CAARMS symptoms; therefore, not surprisingly, the ARMS + group had poorer functioning than the ARMS- group.

All of the ARMS + subjects belonged to the Attenuated Psychotic Syndrome (APS) group. Presence of the APS symptoms can cause significant distress, with greatest contribution of non-bizarre ideas [36]. Clustering of ARMS + individuals according to specific psychopathology can improve our ability to predict which of them develop psychosis [37].

Results of a longitudinal study with help-seeking ultra-high risk youth showed that individuals with comorbidities had more severe symptoms, higher distress and lower level of functioning [38]. In addition, those with both comorbid anxiety and depressive diagnoses were more severely functionally impaired. Even though the presence of current threshold or subthreshold diagnosis in our sample was not

associated with the social and occupational functioning, the comorbidity rate was lower than in previously published studies [14, 30–31].

Our results suggest that the subclinical psychotic syndrome in the population of adolescents, even non-help seeking, have negative impact on their quality of life. We observed negative association between the severity of CAARMS symptoms and five subscales of KIDSCREEN, namely: Physical Well-being, Psychological Well-being, Moods and emotions, Self-Perception, Parent and Home life. These domains cover crucial aspects of daily life, provide information on general health, life satisfaction, mood, loneliness, relations with parents. The results further corroborate findings from previous study, in which the authors showed with the same QoL instrument (KIDSCREEN52) that the ARMS subjects had poorer results than controls in Physical Well-being, Psychological Well-being and School Environment [39].

Somewhat surprisingly, we failed to detect any significant difference in cognitive performance between the ARMS + and ARMS- groups. The data contradict previously reported impairment in processing and motor speed among non-help seeking ARMS subjects [16]. The discrepancy can be partially explained by different recruitment methods used and dissimilar cognitive tests administered. Haining and collaborators used online-screening approach to enrol participants and assessed cognitive performance with Brief Assessment of Cognition in Schizophrenia and three tasks from the CNB battery (the Continuous Performance Test, the N-Back Task and the Emotion Recognition Task) [16]. Another possible explanation of our negative findings is a relatively small, thus possibly underpowered, sample size. Furthermore, cognitive performance in our study was not associated with the CAARMS symptoms severity, neither with the presence of threshold or subthreshold mental disorder. The lack of associations can be attributed to the lower prevalence of comorbidities.

People commonly do not seek help until their problems are severe enough to interfere with their occupational or psychosocial functioning [35]. Even then, the reasons for persons with the ARMS symptoms to ask for help are mainly driven by depressed mood or anxiety [40].

In our study, we observed that adolescents with at-risk mental state experience significant functional decline compared to their healthy peers. It has been previously stated that the risk of transition into psychosis grows along with increasing intensity of subthreshold psychotic symptoms and decrease in functioning [37]. The challenge is what kind of help can we offer and deliver to the non-help seeking ARMS subjects. In general, treatment of the ARMS individuals has two aims: to manage current symptoms and problems, and to reduce the risk of developing a psychotic disorder [41]. Current international guidelines recommend the least restrictive approach, i.e. psychological interventions as the first-line treatment, while the administration of antipsychotics is reserved for patients who do not respond to psychological management or who suffer from severe and/or progressive high-risk symptoms [42, 43]. There are also reports indicating that cognitive remediation in the ARMS subjects can improve functional outcome and cognition in the domains of verbal memory, attention, and processing speed, but the data are rather scarce [44].

Study limitation is the absence of assessment of negative symptoms across our sample. Several studies suggested that cognitive, social, and functional impairments in help-seeking individuals are associated more strongly with negative symptoms (mostly affective flattening and avolition-apathy), than with positive or depressive symptoms [13, 45–46]. Since the tools for assessment of ARMS status are designed to evaluate the risk of transition to psychosis, they emphasize the importance of positive symptoms and thus the importance of early negative symptoms is often overlooked.

Conclusion

Our findings suggest that non-help seeking adolescents with at-risk mental state have overall worse level of functioning compared to controls. Reduction of functioning is negatively associated with the severity of their subsyndromal psychotic symptoms. Finally, they are also at higher risk to develop comorbid psychiatric disorders.

Abbreviations

ARMS: At-risk mental state

CAARMS: Comprehensive Assessment of At Risk Mental States interview

SOFAS: Social and Occupational Functioning Assessment Scale

QoL: Quality of life

APS: Attenuated psychotic symptoms

BLIPS: Brief limited intermittent psychotics symptoms

K-SADS: Kiddie-Schedule for Affective Disorders and Schizophrenia

RCFT: Rey complex figure test

RAVLT: Rey auditory verbal learning test

WMS-LM: Logical memory subtest of the Wechsler Memory Scale

TMT A: Trail making test part A

DS: Digit symbol coding test

TMT B: Trail making test part B

WMS-III: Wechsler Memory Scale – Third Edition

SD: Standard deviation

ARMS+: At risk mental state positive

ARMS-: At risk mental state negative

Declarations

Ethics approval and consent to participate

Study protocol was approved by the Ethical Committee of the National Institute of Mental Health, Klecany, Czech Republic. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and other applicable laws and regulations. All participants older than 18 years provided written informed consent, for participants younger than 18 years the consent was obtained from their parents/legal representatives.

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Author's contributions

PM and MR designed and directed the project. PS, AS, PK, AD, VV, JJ collected the data. TS analysed the data. PS took the lead in writing the manuscript. PM aided in interpreting the results and worked on the manuscript. All authors discussed the results and commented on the manuscript.

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Figures

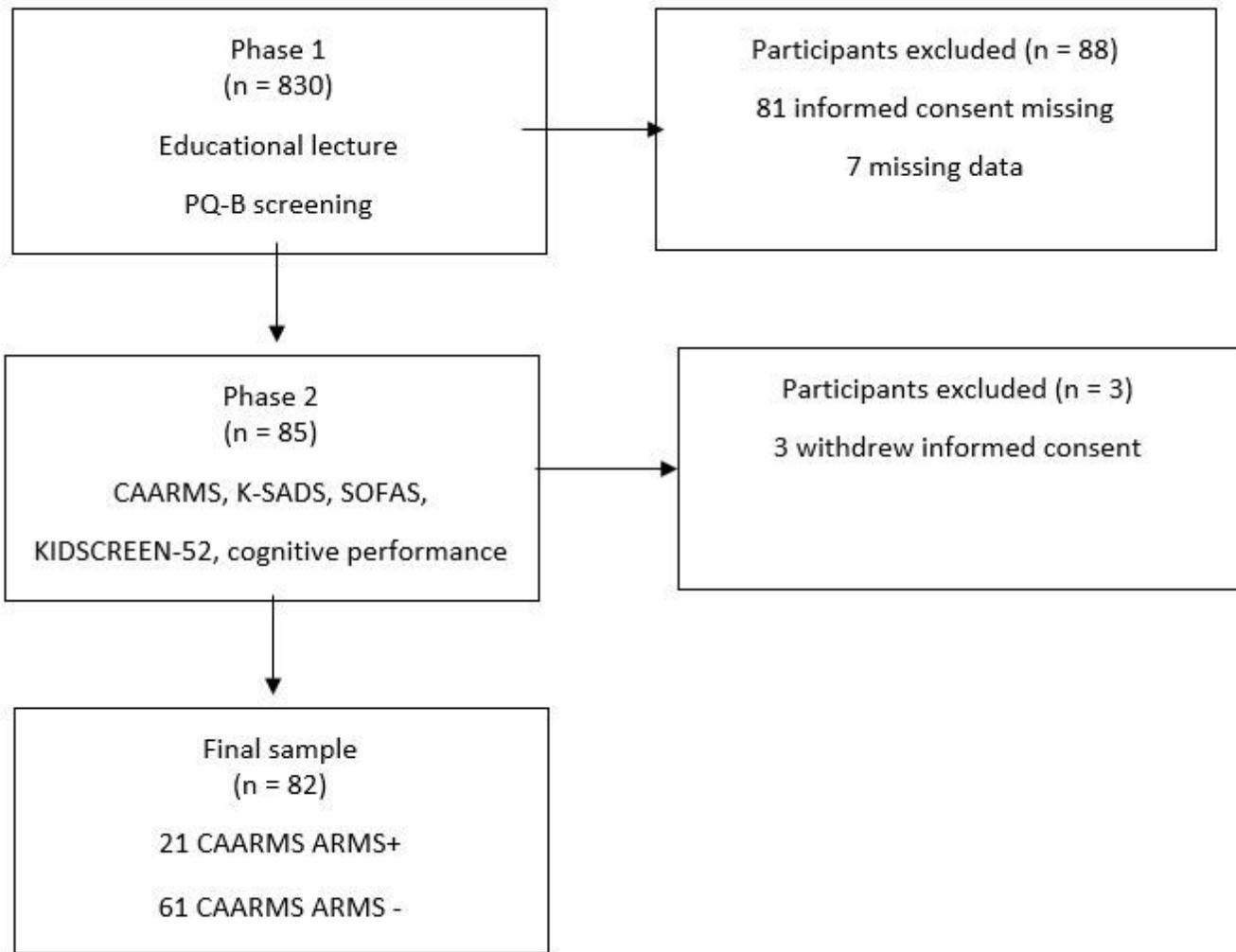


Figure 1

Study flow, recruitment and assessment pathway Abbreviations: PQ-B, Prodromal Questionnaire-Brief version; CAARMS, The Comprehensive Assessment of At Risk Mental States; K-SADS, Kiddie Schedule for Affective Disorders and Schizophrenia; SOFAS, Social and Occupational Functioning Assessment Scale; ARMS, At Risk Mental State.