Childhood psychotic experiences are associated with poorer global functioning throughout adolescence and into early adulthood.

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Childhood psychotic experiences are associated with persistently poorer global functioning into early adulthood.

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Abstract

Background: Psychotic experiences (PEs) are common in childhood and have been associated with concurrent mental disorder and poorer global functioning. Little is known about the effects of childhood PEs on future functioning. We investigated the effects of childhood PEs on global functioning from childhood into early adulthood.

Method: 56 participants from a community sample completed all three-waves of the Adolescent Brain Development study (T1$\bar{x}$Age: 11.69, T2$\bar{x}$Age:15.80 T3$\bar{x}$Age:18.80). At each phase, participants completed a clinical interview assessing for PEs, mental disorder and global function. Repeated measures models, adjusting for mental disorder and gender, were used to compare current (C-GAF) and most sever past (MSP-GAF) functioning in participant with childhood PEs and controls.

Results: Participants with a history of PEs had significantly poorer C-GAF ($p < .001$) and MSP-GAF scores ($p < .001$). Poorer functioning was evident in childhood (C-GAF: $p = .001$; and MSP-GAF: $p < .001$), adolescence (C-GAF: $p < .001$; and MSP-GAF: $p = .004$) and early adulthood (C-GAF: $p = .001$; and MSP-GAF: $p = .076$). There was no effect of time or interaction.

Discussion: Children who report PEs have persistently poorer functioning through to early adulthood. The long-term association between childhood PEs and global functioning highlights the underlying global vulnerability in children reporting PEs, beyond what can be explained by mental disorder.

Keywords: Adolescent Development, Psychosis & Mental Disorders

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Significant outcomes:

- **Individuals who report psychotic experiences in childhood have persistently poorer functioning into early adulthood.**
- **This association was above and beyond what can be explain by mental disorder diagnoses.**
- **These results were also evident in young people whose psychotic experiences were transient.**

Limitations:

- **The data comes from a relative small longitudinal community sample.**
- **Attrition rate were only adequate relative to the overall sample.**
- **Global function is a composite metric and future research is necessary to fully determine the effects of psychotic experiences on symptomology, social and occupational functioning separately.**

Childhood PEs and persistent poorer functioning.

Childhood psychotic experiences (PEs) are highly prevalent, with 17% of children reporting such experiences[1]. PEs during childhood and early adolescence are associated with both psychotic and non-psychotic disorders [2-7]. Findings from longitudinal studies also suggest that children who report PEs have an increased vulnerability to subsequent mental disorders [-8-9]. For example, Fisher et al.[8] reported that more than 90% of those who had PEs in childhood had at least one mental disorder by age 38.

It has been reported that children with PEs have poorer global functioning than their peers [2,10-12]. Global functioning is an important measure that has been commonly used in research and clinical practice [13]. Assessments of functioning 'allows the rater to assimilate and synthesize his or her knowledge about many different aspects of the patient's social and psychiatric functioning, and condense it into a single clinically meaningful index of severity of disturbance' (p.1228) [14]. Functioning has been shown to be a valuable measure for identifying individuals in need of treatment [15-16], measuring the effectiveness of a treatment [17] and has prognostic value for predicting transition to psychosis and outcomes in first episode patients [18-19]. While PEs in childhood have been associated with concurrent poorer functioning, to date little is known about the effects of childhood PEs on subsequent functioning. To our knowledge, only Calkins et al. [20] has investigated the longitudinal effects of PEs on global functioning - over a two-year follow up period. Their results indicated that those who reported transient PEs still had poorer global functioning scores then controls. We investigated the longitudinal association between childhood PEs and global functioning from childhood into early adulthood.

Aims

The aims of this study were 1) to investigate the relationship between childhood PE and global functioning during childhood, adolescence and early adulthood independent of mental disorder, 2) to investigate whether poorer functioning was evident into adulthood after accounting for

childhood functioning and 3) to investigate if poorer functioning was evident in those with transient PEs in childhood.

Method

Participants

The participants were a subgroup of the Adolescent Brain Development (ABD) study, an Irish community sample who have completed three waves of assessment; once in childhood (age 11-13 years), once in adolescence (age: 14-16 years) and once in early adulthood (age: 17-21 years). The recruitment process for the study has been described in detail [21]. The ABD study sample comprises of 212 participants aged between 11 and 13 years recruited from schools in the Dublin region. They attended a clinical interview and cognitive assessment. Additionally, 100 of these participants also had an MRI scan. This 100 subgroup were invited to take part in a follow-up study (T2; aged 14-16) and 86 agreed to take part; detailed clinical interview, cognitive assessment and MRI scan. All 86 were then invited to take part in a further follow up (T3; aged 17-21) with a similar procedure and 56 (65%) agreed to take part (see Figure 1). Ethical approval for the study was received from the Beaumont Hospital medical ethics committee.

Figure 1. Flow chart of the assessment procedure for this investigation.

Insert Figure 1 (Assessment Procedure)

Exposure measure

Clinical Interview: At all time points (T1-T3), Axis-I disorders, and psychotic experience were assessed using the Schedule for Affective Disorders and Schizophrenia for School-aged

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Children (K-SADS) [22]. The K-SADS is a well-validated semi-structured research diagnostic interview for the assessment of a wide range of mental disorders in children and adolescents. For consistency, a modified version of the K-SADS was re-administered at T3. At T1 both the participant and his or her parents were interviewed separately by a psychiatrist or a psychologist. At T2 and T3 only the participants were interviewed.

Current and Past Disorder. At each interview participants were assessed for current and past mental disorder. Specifically, participants who reported symptoms which met diagnostic criteria within the last month were classified as having a current mental disorder. For past mental disorder, participants had to meet diagnostic criteria at any time since the last assessments (T1 past disorder was the measure of disorder until the first assessment).

Psychotic experiences: The psychosis subsection of the K-SADS is designed to assess a range of hallucinations and delusional thinking. Detailed notes were taken of any endorsed psychotic experiences. All interviewers were given extensive training on the assessment of any reported psychotic or psychotic-like experiences. In every case where a participant endorsed any psychotic or psychotic-like experience, these were independently rated and classified based on PE criteria developed by Kelleher & Cannon [23]. In brief, PEs were judged based on a number of qualities including: the content of the experience, the attribution of the experience (personal interpretation of the phenomena), the certainty of this attribution on reality testing (i.e. might have been my imagination/definitely wasn't my imagination), the clarity of the experience (degree of ambiguity in the description), and the degree of distress/impairment the experience caused (i.e. very/somewhat/not distressing). Endorsement of any psychotic or psychotic-like experience was discussed and subsequently rated at a consensus meeting by three experts in psychosis. None met criteria for a psychotic disorder.

Outcome measures.

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Global Assessment of Functioning. Global functioning was assessed using the Children's Global Assessment Scale at time points one and two [14] and the Global Assessment of Functioning scale at time point three [24]. The children's global assessment scale is a validated measure of global functioning adapted from the global assessment of functioning (GAF) scale for adults. Both are scored on a 100 point scale which is divided into ten levels, with a lower score indicating more severe impairment. Scores between 1 and 10 indicate very severe impairment ('needs 24-hour care/supervision') while scores between 91 and 100 indicate superior functioning in all areas. For the purpose of this investigation the current (C-GAF) and most severe past scores (MSP-GAF) at each time point were used in the investigation. The C-GAF is a measures of global functioning within the last month while the MSP-GAF is a measure of the poorest level of functioning since the last assessments (T1 MSP-GAF measures the poorest level of functioning until the first assessment). These measures were treated as a continuous variable.

Statistical Analysis

Demographics. Standard parametric testing was used to investigate differences in demographics between those with and without a history of PEs.

Primary analysis.

Association independent of mental disorder. A full factorial fixed-effect repeated measures model was used to investigate the effects of childhood PEs on global functioning overtime. Group (childhood PEs and controls) and Time (T1-T3) were entered as independent variables in the model. Additionally the model was adjusted for gender and mental disorder (adjusting for current mental disorder when C-GAF was the dependent variable and past mental disorder when MSP-GAF was the dependent variable). A restricted maximum-likelihood, auto-regressive model was used accounting for repeated co-variance of participant and time. C-GAF scores and MSP-GAF scores were investigated as dependent variables separately. Additionally,

post-hoc simple effects analysis, was used to investigate the effects of childhood PEs on GAF scores at each time point, again adjusted for gender and mental disorder.

Secondary Analyses.

Accounting for childhood functioning. To investigate the causal relationship between psychotic experiences and poorer functioning we conducted a secondary analysis which accounts for childhood functioning (T1 C-GAF and T1 MSP-GAF) as well as mental disorder and gender. The same statistical approach as the primary analysis was used but the outcomes were restricted to adolescent and early adult functioning. Again C-GAF and MSP-GAF scores were the dependent variables. Similar to the approach taken with mental disorder, T1 C-GAF was accounted for when in C-GAF was the dependent variable and T1 MSP-GAF was accounted for when MSP-GAF was the dependent variable.

Tertiary Analyses.

Restricted analysis of those with transient childhood psychotic experiences. A secondary analysis was conducted using the same methodology as the primary analysis, however this analysis was restricted to those who only report psychotic experiences in childhood – transient childhood psychotic experiences (66.67% of participants).

All statistical analysis was conducted using SPSS 22 for windows.

Results

Missing data comparison

There were no significant difference in the variables of interest at baseline between those who attended all three waves of follow up and those who did not (gender, years in education, PEs prevalence, mental disorders prevalence, C-GAF and MSP-GAF scores, all $p < .25$). There was a significant difference in age which indicated that at baseline participants who attended all

three waves were slightly older than those who did not attend for follow up (attendees $\bar{x}$: 11.69 SD:0.69 non-attendees $\bar{x}$: 11:47 SD: 0.57, $p = .046$).

Demographics of participants

56 (65.11% retention) participants took part in the all three waves of the study. 32.1% had a history of childhood PEs. Table 1 depicts the descriptive demographic information of those with and without a history of childhood PEs. There were no significant differences in the demographic variables between participants with and without a history of childhood PE.

Table 1. Demographic results for participant with and without a history of childhood PEs.

Insert Table 1 (Demographic Results)

Primary analysis

Relationship between psychotic experiences and functioning independent of mental disorder.

C-GAF. Participants with a history of childhood PEs had overall significantly lower C-GAF scores than their peers ($F = 39.858$, $p < .001$, see Figure 2 and Table 2). There was no significant effect of time indicating that functioning scores were stable over time ($F = 0.031$, $p = .969$). There was no significant interaction between time and group ($F= 0.230$, $p = .795$).

Simple effects analysis. Simple effects analysis indicated that at each time point participants with a history of childhood psychotic experiences had significantly poorer C-GAF scores peers (see Table 2) than their peers (Childhood: $p = .001$; Adolescence: $p <.001$; and Early Adulthood: $p = .001$). *Covariates*. Participants with current mental disorders had significantly poorer C-GAF scores than their peers ($F = 20.017$, $p < .001$). There was no significant main effect of gender ($F = 0.004$, $p = .951$).

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MSP-GAF. Participants with a history of childhood PEs had significantly lower MSP-GAF than their peers (F= 20.177, p < .001, see Figure 2). There was a significant effect of time (F = 9.941, p < .001), with participants having poorer MSP-GAF scores in mid-adolescence (p < .001) and early adulthood (p = .005) than in childhood. There was no significant interaction between time and group (F= 0.219, p = .804).

Simple effects analysis. Simple effects analysis indicated that those with a history of childhood psychotic experiences had lower MSP-GAF scores than their peers (see Table 2) during childhood (p < .001), adolescence (p = .004) and somewhat in early adulthood (p = .076).

Covariates. Participants who met criteria for past mental disorder had significantly poorer MSP-GAF than their peers (F = 114.017, p < .001). Males participants had significantly lower MSP-GAF scores then females (F = 4.506, p = .038).

Figure 2a. Current and most severe past global functioning scores for participants with and without childhood psychotic experiences. 2b. Current and most severe past global functioning scores for participants with and without transient psychotic experiences (experiences reported in childhood alone). All scores are adjusted for the effects of mental disorder and gender.

Insert Figure 2 (Line Graph of Scores)

Secondary analysis

Accounting for childhood functioning.

C-GAF. There was a significant main effect of group (F = 17.569, p < .001) which indicated that overall participants with a history of childhood PEs continue to have lower C-GAF scores than their peers even after accounting for mental disorder and childhood functioning. There

was no significant effect of time (F = 0.011, p = .916). There was no significant interaction between time and group (F= 0.027, p = .869).

Simple effects analysis. Simple effects analysis indicated that participants with a history of childhood psychotic experiences had significantly poorer C-GAF scores than their peers during adolescence (p < .001) and early adulthood (p = .004, see Table 2).

Covariates. Participants with current mental disorders had significantly poorer C-GAF scores than their peers (F = 12.234, p = .001). There was also a significant main effect of childhood functioning (T1 C-GAF) which indicated that those with poorer functioning in childhood also had poorer functioning in later life (F = 5.727, p = .02). There was no significant main effect of gender (F = 2.476, p = .121).

MSP-GAF. There was no significant main effect of group (F= 2.697, p = .106) which indicated that after accounting for poorest level of function in childhood and mental disorder participants with a history of childhood PEs did not differ from their peers in adolescent and early adulthood MSP-GAF scores (see Table 2). There was no significant effect of time (F = 0.700, p = .407) and there was no significant interaction between time and group (F= 0.007, p = .933).

Covariates. Participants who met criteria for past mental disorder had significantly poorer MSP-GAF than their peers (F = 100.534, p < .001). There was also a significant main effect of childhood functioning (T1 MSP-GAF) which indicated that those with a history of poorer functioning in childhood also had poorer functioning in later life (F = 14.025, p < .001). There was no significant main effect of gender (F = 0.179, p = .674).

Table 2. The mean and standard error GAF scores for each group through time for the primary and secondary analysis.

Insert Table 2 (Adjusted and Unadjusted comparison of GAF scores at each time point)

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Tertiary analysis.

Restricted analysis, those who only report psychotic experiences in childhood – transient psychotic experiences.

66.6% of participants only reported PEs in childhood. For this analysis, the 33.3% of participants who reported PEs in adolescence or early adulthood were removed.

C-GAF. There was a significant main effect of group ($F = 24.141$, $p < .001$) which indicated that overall participants with transient childhood PEs had poorer C-GAF scores than their peers (See Figure 2). There was no significant effect of time ($F = 0.098$, $p = .906$). There was no significant interaction between time and group ($F= 0.163$, $p = .850$).

Simple effects analysis. Simple effects analysis indicated that at each time point participants with a history of childhood psychotic experiences had poorer C-GAF scores than their peers (Childhood: $p = .007$; Adolescence: $p =.001$; and Early Adulthood: $p = .003$).

Covariates. There was a significant main effect of mental disorder ($F = 13.069$, $p < .001$) but no significant effect of gender on C-GAF scores ($F = 0.009$, $p = .925$).

MSP-GAF. There was a significant main effect of group ($F= 14.620$, $p < .001$) which indicated that overall participants with transient childhood PEs had lower MSP-GAF scores than their peers (See Figure 2). There was a significant effect of time ($F = 7.760$, $p = .001$) with participants having poorer MSP-GAF scores in mid-adolescence ($p = .001$) and early adulthood ($p =.008$) than in childhood. There was no significant interaction between time and group ($F= 0.41$, $p = .960$).

Simple effects analysis. Simple effects analysis indicated that at each time point participants with a history of childhood psychotic experiences had poorer MSP-GAF scores than their peers (Childhood: $p = .003$; Adolescence: $p = .021$; and Early Adulthood: $p = .056$).

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Covariates. There was a significant effect of history of mental disorder ($F = 91.247$, $p < .001$). There was no significant main effect of gender ($F = 3.664$, $p = .061$).

Discussion

In a community sample, we demonstrated for the first time that participants with a history of childhood PEs have persistently poorer global functioning throughout adolescence and into early adulthood. This effect was above and beyond what can be explained by mental disorder. This functional impairment was evident in both global functioning measures (current and most severe past), with highly significant and clinically relevant differences evident at all time points (childhood, adolescence and early adulthood) characterised by scoring at least a one functional category lower than their peers on the GAF (average ~15 points). Their scores formally constitutes "probable to definite" functional impairment requiring intervention based on Bird et al.[15] and Polanczyk et al.[25] meta-analysis definition of functional impairment. This vastly differs from their peers who were characterised as only having symptoms which were transient and an expectable reaction to a psycho-social stressor and coupled with little to no impairment in social and occupational functioning. The long-term association between childhood PEs and global functioning reflects an underlying global vulnerability in children reporting such experiences which extends beyond diagnosable mental disorder. Additionally this relationship was present even after accounting for childhood functioning which suggests that childhood PEs are a trait, as opposed to state, marker for poorer general functioning.

These results concur with findings from Calkin et al. [20] who reported that poorer functioning was evident even in participants with transient PEs. They also complement longitudinal studies indicating that those with PEs are vulnerable to subsequent mental disorder [8, 26-27].

Interestingly, after accounting for childhood functioning and mental disorder, we observed a relationship between childhood psychotic experiences and adolescent/adult 'current'

functioning but not 'most severe past' functioning. One possible explanation for this is that the poorest level of functioning during any period may be state dependent, reflecting a reaction to on-going psycho-social stressors. The association with current functioning suggests a trait characteristic as most of the young people with a history of childhood PEs did not meet criteria for an on-going mental disorder at the time of interview, yet persistently poorer functioning was still evident.

The mechanisms for the poorer functioning in those with childhood PEs are not known and few studies have investigated candidate mechanisms. In a clinical sample of adolescent psychiatric patients, Wigman et al.[28] reported that those with PEs were more likely to adopt an avoidant coping strategy and a sub-analysis tentatively suggests that this may be related to poorer functioning. Additionally, Kelleher et al.[12] reported that trauma, psychiatric disorder and certain cognitive domains, namely speed of processing/set shifting and visual working memory, moderate the relationship between childhood PEs and childhood functioning but did not fully mediate this relationship. To the authors' knowledge no study has investigated the mechanisms of longitudinal association between PEs and global functioning.

The results concur with finding suggesting that PEs in childhood represent an excellent marker for co-occurring and subsequent mental disorder and supports the motion that children presenting with PEs should be monitored closely as they have a higher risk of subsequent mental disorder than their peers. Mental disorders most often occur in the first two decades of life and are one of the greatest contributors to the global economic burden [29-31]. Projections of the economic cost of mental disorders do not include the costs associated with the unknown number of people who have functional difficulties but do not meet criteria for a diagnosable disorder. Utilising early markers for functioning deficits as well as mental disorder and intervening accordingly may not only improve outcomes for those at risk but also benefit society with increased global productivity.

Strengths and Limitations.

There were a number of strengths and limitations to this study. PEs, mental disorder and global functioning measures were all based on face-to-face clinical interviews, with characterised criteria for defining PEs. Transcriptions of the notes on PEs from these interviews were also reviewed at a consensus meeting by three experts in psychosis. The global functioning measures used were well validated measures for assessing functioning. The sample used within this study is a population community based sample, however attrition rates were only adequate and the ratio of those with PEs within this group is over-estimated relative to what is observed in the general population at this age range. Nevertheless the results are in line with other investigations of the association between PEs and global functioning.

To conclude, children who report psychotic experiences have persistently poorer global functioning in childhood and as they develop into early adulthood. Persistent global dysfunction suggests an underlying vulnerability which extends beyond diagnosable mental disorder. Despite the fact that most PEs are transient their effects can be long lasting.

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Declaration of Interest: None

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Figure 1. Flow chart of the assessment procedure for this investigation.

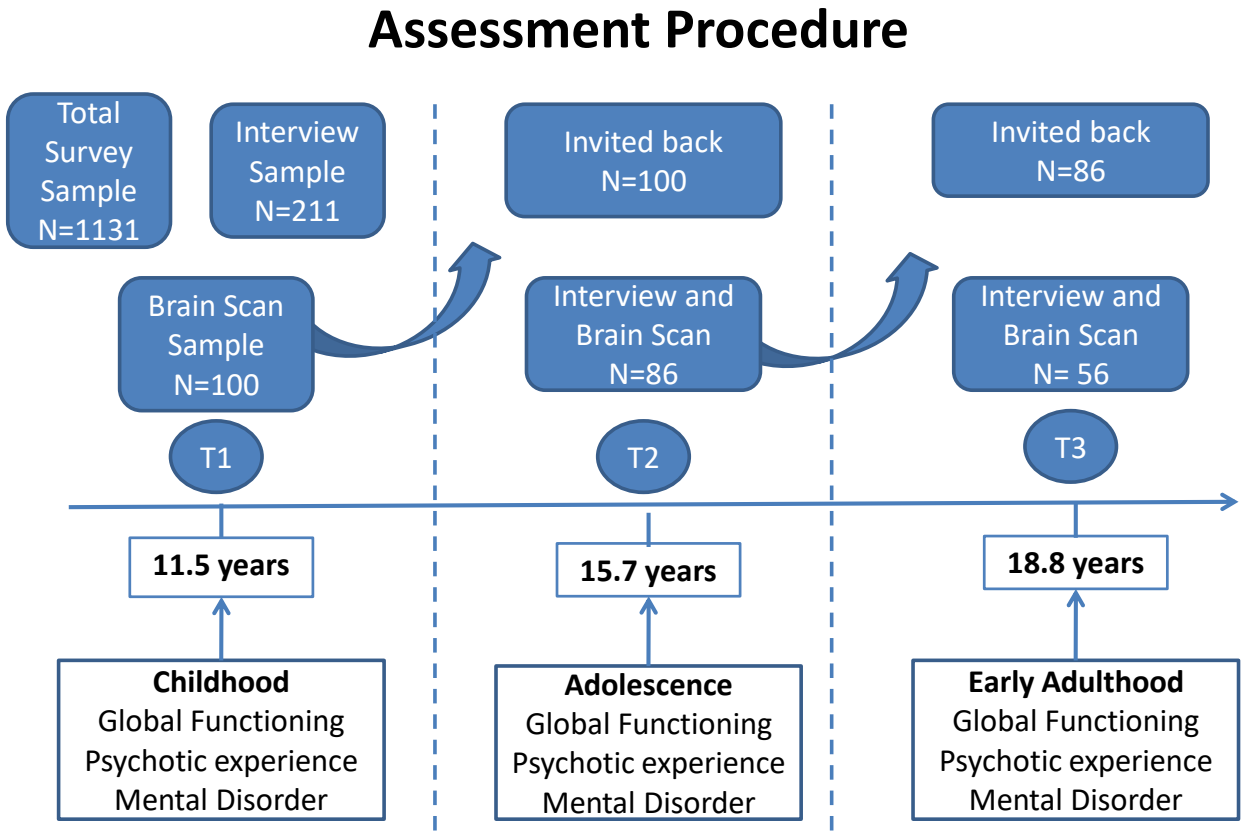

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Table 1. Demographic results for participant with and without a history of childhood PEs.

Demographics	**Childhood Psychotic Experiences (n=18)**	**Controls (n=38)**	**p-value**
Gender (male/ female)	12/6	16/22	n/s
Age (years)			
T1	11.67	11.68	n/s
T2	15.83	15.82	n/s
T3	18.81	18.79	n/s
Education Level (years):			
T1. Primary Education	5.39	5.55	n/s
T2. Secondary Education	3.83	3.82	n/s
T3. Age of School Completion	17.86	17.80	n/s
T3. Currently Occupational Status (%)			
Still in School	17.6	15.8	
In 3rd Level Education	70.6	73.7	
Working	5.3	5.9	
Seeking Employment	5.3	5.9	
Mental Disorder (%)			
T1 Current	38.9	18.4	.099
T1 Past	61.1	31.6	.036

T2 Current	11.1	5.4	n/s
T2 Past	55.6	16.2	.003
T3 Current	12.5	9.7	n/s
T3 Past	56.3	22.6	.021

Note: n/s = non-significant ($p > .05$)

Childhood psychotic experiences are associated with persistent poorer global functioning

Figure 2a. Current and most severe past global functioning scores for participants with and without childhood psychotic experiences. 2b. Current and most severe past global functioning scores for participants with and without transient psychotic experiences (experiences reported in childhood alone). All scores are adjusted for the effects of mental disorder and gender.

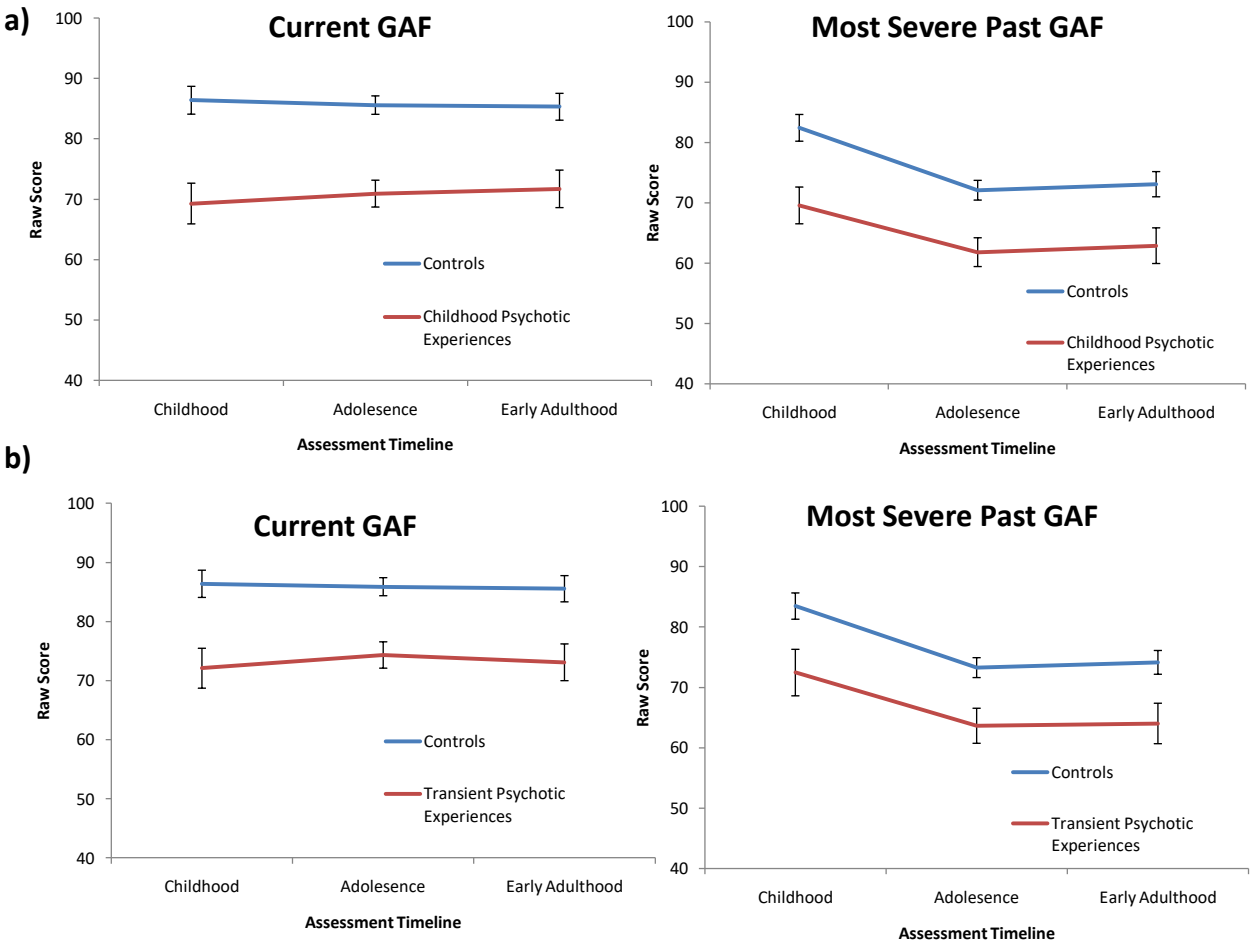

Table 2. The mean, standard error and simple effects analyses of the GAF scores from the primary and secondary analyses.

		Unadjusted	**Adjusted for gender and mental disorder**	**Adjusted for gender, mental disorder and childhood functioning**
Current - Global Functioning				
Childhood	*Childhood PEs*	66.86 (3.68)***	69.63 (3.58)**	-
	Controls	85.10 (2.68)	86.20 (2.56)	-
Adolescence	*Childhood PEs*	71.26 (2.38)***	70.73 (2.21)***	72.95 (2.32)***
	Controls	86.14 (1.69)	84.48 (1.59)	84.60 (1.57)
Early	*Childhood PEs*	71.56 (3.25)***	71.47 (3.27)**	73.51 (3.34)**
Adulthood	*Controls*	86.79 (2.30)	85.86 (2.51)	86.19 (2.52)
Most Severe Past - Global Functioning				
Childhood	*Childhood PEs*	62.77 (3.57)***	69.63 (3.17)***	-
	Controls	84.49 (2.76)	82.92 (2.40)	-
Adolescence	*Childhood PEs*	57.01 (3.26)***	61.83 (2.46)*	66.74 (2.41)
	Controls	76.73 (2.31)	72.01 (1.76)	70.10 (1.67)
Early	*Childhood PEs*	55.96 (3.89)***	62.89 (3.15)~*	68.22 (3.20)
Adulthood	*Controls*	77.41 (2.75)	73.92 (2.38)	72.73 (2.32)

*Note: *** = p <.001; ** = p <.01; * = p <.05; and ~*= p <.1*