

The Structure of The Extended Psychosis Phenotype in Early Adolescence—A Cross-sample Replication

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The extended psychosis phenotype, or the expression of nonclinical positive psychotic experiences, is already prevalent in adolescence and has a dose-response risk relationship with later psychotic disorder. In 2 large adolescent general population samples ($n = 5422$ and $n = 2230$), prevalence and structure of the extended psychosis phenotype was investigated. Positive psychotic experiences, broadly defined, were reported by the majority of adolescents. Exploratory analysis with Structural Equation Modelling (Exploratory Factor Analysis followed by Confirmatory Factor Analysis [CFA]) in sample 1 suggested that psychotic experiences were best represented by 5 underlying dimensions; CFA in sample 2 provided a replication of this model. Dimensions were labeled Hallucinations, Delusions, Paranoia, Grandiosity, and Paranormal beliefs. Prevalences differed strongly, Hallucinations having the lowest and Paranoia having the highest rates. Girls reported more experiences on all dimensions, except Grandiosity, and from age 12 to 16 years rates increased. Hallucinations, Delusions, and Paranoia, but not Grandiosity and Paranormal beliefs, were associated with distress and general measures of psychopathology. Thus, only some of the dimensions of the extended psychosis phenotype in young people may represent a continuum with more

severe psychopathology and predict later psychiatric disorder.

Key words: psychosis/positive symptoms/adolescents/normal population/CAPE

Introduction

The prevailing viewpoint is that the fundamental processes underpinning psychotic disorders such as schizophrenia are such that there is continuity and population distribution of experience.¹ Subclinical phenotypes of psychosis can be readily identified, are more prevalent than the clinical phenotypes, and are associated with many of the same environmental and nongenetic risk factors as the clinical phenotypes, implying continuity of experience, even though taxometric evidence suggests that although there is continuity of experience, the population structure of psychosis—defined broadly to include liability states—may not be continuous with normality.²

Systematic review of general population studies suggests that, from an epidemiological perspective, psychotic experiences in nonill people may represent the behavioral expression of increased liability for psychotic disorder.¹ Although the great majority will never make the transition to clinical psychosis, even after extended periods of follow-up,³ a continuous dose-response risk function exists between psychotic experiences and later disorder.¹ Most of the studies on the psychosis continuum focused on adults rather than on young people, even though the expression of (clinical and subclinical) psychosis typically emerges in adolescence and steeply declines with age.^{4,5}

Adolescence is a period in which psychotic experiences are relatively frequently reported in unselected general population samples.^{6,7} The great majority of these experiences are transient,⁸ ie, never progress to clinical psychotic disorder.⁹ Accordingly, only a small part of the total expression of risk in general population adolescent samples can be considered as true positive if used as a test for later psychopathology.¹⁰ Even though psychotic experiences in unselected general population samples do predict transition to psychotic disorder,^{2,11–14} some

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experiences, such as ideas of reference and suspicion arising in challenging social contexts may form part of the normal process of growing up. The nonperfect prediction of psychotic experiences may suggest underlying heterogeneity, eg, related to different types of psychotic experience.¹⁵

Although psychotic as well as schizotypal experiences can be grouped into several dimensions,¹⁶ including dimensions resembling negative symptoms, it is the dimension of positive experiences, ie, hallucinations and delusions, that has been shown to strongly predict later clinical psychotic outcome in epidemiological studies,^{11,13,14} providing a rationale for an initial focus on positive psychotic experiences. Recent work suggests that the positive domain of psychotic experiences in fact represents several subdimensions. For example, Stefanis and colleagues¹⁷ distinguished 4 subdimensions (Paranoia, First rank symptoms, Hallucinations, and Grandiosity), whereas Verdoux and colleagues⁵ proposed 7 dimensions of delusional ideation (Persecution, Thought Disturbances, Grandiosity, Paranormal beliefs, Reference-Guilt, Religiosity, and Apocalyptic ideas). Both these studies were conducted in adult nonclinical populations. In addition, Yung and colleagues¹⁸ reported 3 dimensions in a clinical adolescent population (Bizarre experiences, Persecutory ideas, and Magical thinking) and 4 dimensions in general population adolescents (Bizarre experiences, Perceptual abnormalities, Persecutory ideas, and Magical thinking).¹⁵ If different subdimensions exist within the positive psychotic dimension, the question rises whether the association with a psychopathological continuum resulting in elevated predictive values for transition to later psychotic disorder may differ between the different subdimensions in adolescents.

Given the fact that several studies show that not just the frequency of psychotic experiences per se, but rather the amount of associated distress predicts transition to need for care and onset of psychotic disorder,^{12,19–22} the degree to which the association between psychotic experiences and distress may differ between the different subdimensions becomes an important first target for analysis. In addition, given the hypothesis of a continuum of psychopathology, analysis of differential associations between subdimensions of the extended psychosis phenotype on the one hand and general measures of psychopathology on the other may be productive.

The prevalence of psychotic experiences during adolescence is associated with both age and sex. Girls aged 12–18 years report more positive experiences than boys,⁶ in accordance with the finding that adult women report more positive experiences than men.²³ In addition, although men have an earlier onset of schizophrenia (ie, have poorer prognosis of subclinical psychotic experiences) than women, girls may report psychotic experiences at an earlier age than boys, possibly because girls reach puberty at an earlier age than boys.^{24,25}

The present study had 4 aims. First, the prevalence of the extended psychosis phenotype expressed as positive psychotic experiences was investigated in 2 large adolescent community samples ($n = 5422$ and $n = 2230$). Second, Exploratory Factor Analysis (EFA) followed by Confirmatory Factor Analyses (CFAs) were conducted in order to investigate the structure in terms of underlying subdimensions of the extended psychosis phenotype. Third, prevalence of psychotic experiences was analyzed in relation to age and sex. Fourth, it was hypothesized that not all dimensions may be equally predictive of later psychopathology and that this would show as differential associations with distress and general psychopathology.

Study 1: Health Behavior in School-Aged Children Study

Methods

Participants. The sampling frame was the Health Behavior in School-Aged Children Study, a general population study investigating health, health behaviors, and its social context in youth in Europe and North America.²⁶ Participants were selected by a 2-stage random sampling procedure, first at school level (proportionate to number in corresponding urbanization level) and second at class level (random selection). Response rate at school level was 47% and at class level 93%. Schools that did not participate did not differ from schools that did participate, resulting in a representative sample of Dutch adolescents. Detailed information on the selection procedure and nonresponse can be found in a report by Currie and colleagues.²⁷ The sample consisted of 5422 adolescents aged 12–16 years (mean age 14.0; SD 1.3; 50% girls). Data were collected in October–November 2005.

Instruments. The Community Assessment of Psychic Experiences (CAPE) positive experiences scale (20 self-reported items) was used to assess psychotic experiences.^{28,29} Each item assesses (a) frequency and (b) distress associated with the experience, both on a 4-point scale (0 = never/not distressed to 3 = nearly always/very distressed). The 20-item scale with both frequency and distress items included showed excellent internal consistency (Cronbach alpha = 0.94).

For model estimation, raw CAPE items were used. In order to investigate effects of sex and age, all 20 frequency items were dichotomized into 0 = never and 1 = sometimes, often or nearly always. This approach was used in order to be consistent with Yung and colleagues,^{15,18} who previously developed this analytical framework. The sum of these 20 dichotomized item scores was used as continuous outcome score, indicating the total number of CAPE item endorsements and hereafter referred to as “CAPE item score.” Similar “CAPE subdimension item scores,” using dichotomous items, were constructed for the 5 CAPE subdimensions. Internal consistency of the dichotomized items was good (Cronbach alpha = 0.83),

and the internal consistencies of the subdimensions Hallucinations, Delusions, Paranoia, Grandiosity, and Paranormal beliefs were acceptable–good (Cronbach alpha of, respectively, 0.76, 0.78, 0.67, 0.69, and 0.66). In addition to the prevalence of the broadly defined contrast of “ever” vs “never,” a narrow prevalence of psychotic experiences, for descriptive purposes, was also calculated, with items dichotomized as 0 = never/sometimes and 1 = often/nearly always.

In order to investigate associations between psychotic experiences and distress, a “frequency score” (sum of all original frequency items, not dichotomized) and a “distress score” (sum of all original distress items, not dichotomized) were calculated for every subdimension.

Given the fact that the CAPE may not be valid in a young age group, a pilot study at a Dutch high school was conducted in a sample of 120 adolescents aged 12–16 years (data not shown). Based on comments received during the debriefing procedure, several minor adaptations were deemed necessary. Thus, minor changes in the wording of some items were introduced. For example, the item about hearing voices when alone was extended with “not on TV or radio.” In the introduction, it was explicitly stated that not everyone might experience these symptoms, but that it is important that everyone fills it in seriously. The pilot suggested both feasibility and validity of the CAPE.

The Strengths and Difficulties Questionnaire (SDQ),³⁰ a screening instrument for youth general psychopathology, was used to assess convergent validity of a psychopathological continuum of the subdimensions.

Statistical Analyses. Model Development Analyses were done in Prelis 2.80³¹ and Lisrel 8.80.³² Structural Equation Modeling (Exploratory Factor Analysis [EFA] followed by Confirmatory Factor Analysis [CFA]) was in an exploratory framework to find a best fitting model. Subsequent models with number of factors ranging from 1 to 6 were investigated. Several fit indices were used. For acceptable model fit, χ^2 (chi-square) should be low, Root Mean Square Error of Approximation (RMSEA) should be lower than 0.05 and the Comparative Fit Index (CFI) should be higher than 0.90. Data were defined as ordinal, and estimation was done with weighted least squares (WLS).³³ Convergent validity of a psychopathological continuum of the subdimensions was assessed by correlating the dimensions with subscales of the SDQ. Correlation coefficients were compared statistically as described by Meng and colleagues.³⁴

Age and Sex In order to assess differences in CAPE item score between the sexes and different age groups, 6 analyses of variance were conducted with CAPE item score and the 5 CAPE subdimensions item scores as dependent variables and sex and age as fixed factors.

Distress The association between frequency score and distress score was investigated by predicting distress

Table 1. Fit Indices of the 6-Factor Models in the Health Behavior in School-Aged Children Study ($n = 5422$)

Models with Number of Factors	Fit Index			
	χ^2	df	CFI	RMSEA
1 factor	1627.60	170	0.86	0.043
2 factors	1217.94	169	0.90	0.036
3 factors	1164.25	167	0.91	0.036
4 factors	951.37	164	0.93	0.032
5 factors	739.18	160	0.95	0.028
6 factors	814.18	156	0.94	0.030

Note: CFI, Comparative Fit Index; RMSEA, Root Mean Square Error of Approximation.

score with frequency score using linear regression, controlling for age and sex. Regression coefficients were compared statistically by Wald test. In this analysis, for each given item, only adolescents who reported an endorsement of at least “sometimes” on that item were included in analyses.

Results

Descriptives. In all, 95% of the participants endorsed at least one psychotic experience on the CAPE at least “sometimes”; 43% endorsed at least one experience “often” or “almost always.” The median CAPE item score was 6 experiences (interquartile range [IQR] 3–9); the 90th percentile was 9 experiences.

Model Development. Building on results from initial EFA, CFA revealed that model improvements occurred from 1- to 5-factor solutions, estimated with Promax rotation, which allows factors to be correlated (data available on request). The 6-factor solution showed no improvement compared with the 5-factor solution, both in content and in model fit. The 5-factor model was the best model as it had the lowest χ^2 and RMSEA and the highest CFI (table 1). In figure 1, the structure of the model, standardized coefficients from latent variables to indicator variables, and correlations between factors are depicted. All coefficients were at least 0.56 (mean factor loading 0.79). Furthermore, the latent variables were found to explain 60.3% of variance in the indicator variables. The 5 factors were labeled “Paranoia,” “Grandiosity,” “Paranormal beliefs,” “Delusions,” and “Hallucinations.” Correlations among the 5 factors were high: The highest coefficients were found between Paranoia, Delusions, and Hallucinations ($r > 0.80$). These results indicate that the level of discrimination between the dimensions varies, depending on the specific content. Prevalences of the factors are shown in table 2 at broad (ever vs never) and narrow (never/sometimes vs often/nearly always) level.

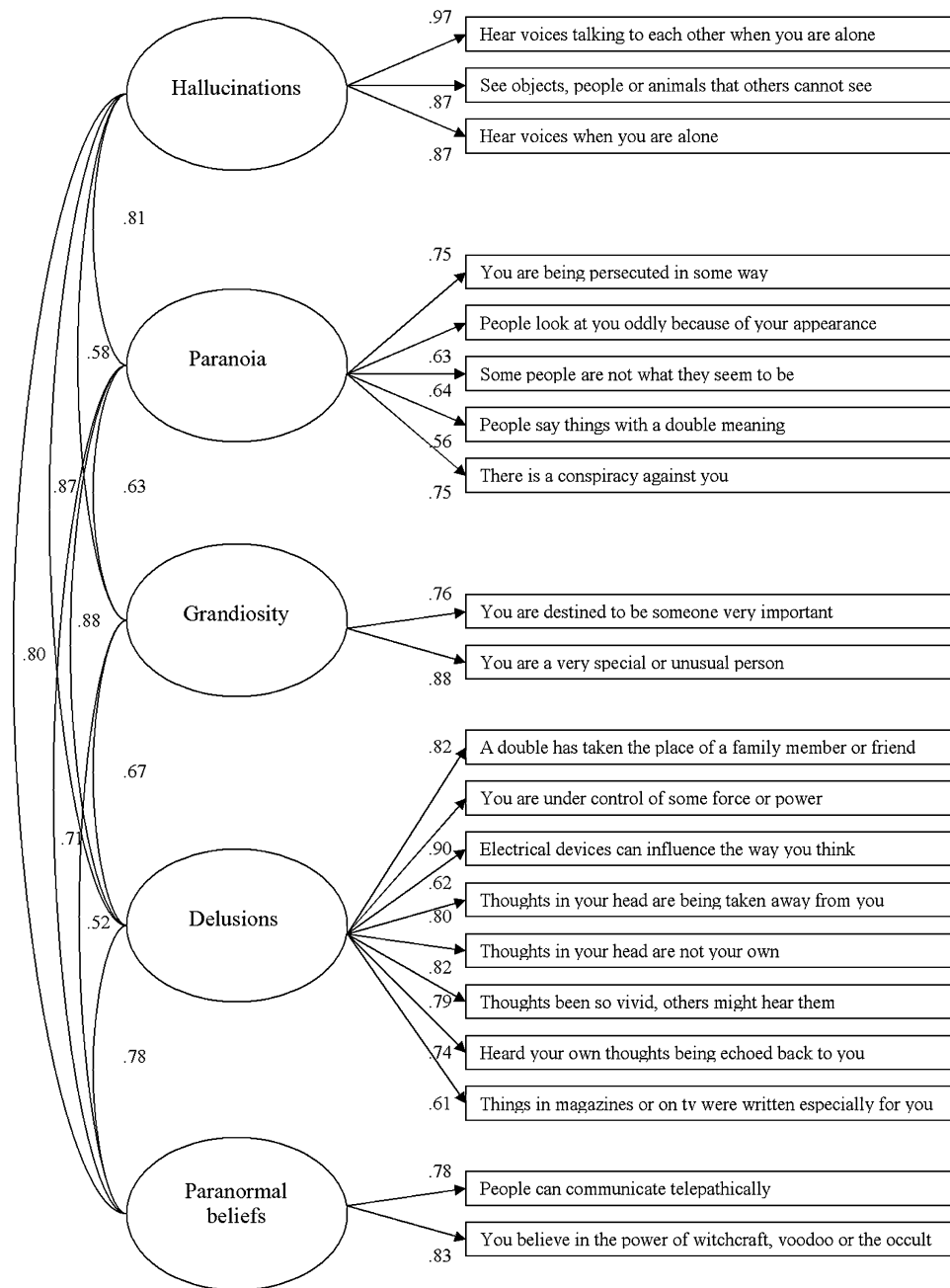


Fig. 1. Model with 5 dimensions and their standardized factor loadings and factor correlations in the Health Behavior in School-Aged Children Study.

Convergent Validity With General Psychopathology. In order to investigate associations between the 5 CAPE positive experience subdimensions on the one hand and general measures of psychopathology on the other, correlations were computed between the 5 CAPE subdimension item scores and the 4 subscales of the SDQ (Hyperactivity, Emotional problems, Conduct problems, and Peer problems; table 3). Overall, Hallucinations, Delusions, and Paranoia showed statistically significantly higher correlations with all SDQ scales ($r =$

0.44–0.78) than Grandiosity and Paranormal beliefs, which had structurally lower correlations with all SDQ scales ($r = 0.18–0.55$).

A similar pattern was apparent within each SDQ subscale. Thus, Hyperactivity was significantly more strongly associated with Hallucinations, Delusions, and Paranoia than with Grandiosity (respectively, $Z = 20.80, P < .001$; $Z = 22.77, P < .001$; and $Z = 21.77, P < .001$) and Paranormal beliefs (respectively, $Z = 16.67, P < .001$; $Z = 16.17, P < .001$; and $Z = 15.90,$

Table 2. Broad and Narrow Prevalence Rates of Subdimensions in the Health Behavior in School-Aged Children Study ($n = 5422$)

Dimension	Prevalence Rate "Ever"	Prevalence Rate "Often"/"Almost Always"
Hallucinations	30.1	6.4
Delusions	66.5	11.2
Paranoia	89.7	26.4
Grandiosity	45.8	12.0
Paranormal beliefs	48.6	16.2
Any CAPE experience	94.8	43.3

Note: CAPE, Community Assessment of Psychic Experiences.

$P < .001$). A similar pattern was apparent for Emotional problems, statistically stronger associations being found with Hallucinations, Delusions, and Paranoia compared with associations with Grandiosity (respectively, $Z = 23.87$, $P < .001$; $Z = 33.47$, $P < .001$; and $Z = 45.04$, $P < .001$) and Paranormal beliefs (respectively, $Z = 8.02$, $P < .001$; $Z = 16.02$, $P < .001$; and $Z = 21.49$, $P < .001$). Conduct problems were also associated statistically more strongly with Hallucinations, Delusions, and Paranoia than with Grandiosity (respectively, $Z = 17.6$, $P < .011$; $Z = 18.18$, $P < .001$; and $Z = 17.12$, $P < .001$) and Paranormal beliefs (respectively, $Z = 22.40$, $P < .001$; $Z = 29.80$, $P < .001$; and $Z = 17.12$, $P < .001$). Finally, Peer problems were also associated statistically more strongly with Paranoia, Delusions, and Hallucinations than with Grandiosity (respectively, $Z = 22.69$, $P < .001$; $Z = 11.36$, $P < .001$; and $Z = 17.80$, $P < .001$) and Paranormal beliefs (respectively, $Z = 25.78$, $P < .001$; $Z = 13.72$, $P < .001$; and $Z = 11.98$, $P < .001$).

Age and Sex. The mean CAPE item score and CAPE subdimension item scores are shown for several age groups and for each sex in table 4.

For both total CAPE and its subdimensions, girls had higher item scores than boys, with the exception of Grandiosity (table 3). In addition, the item scores increased between the age of 12 and 16 years for total CAPE and particularly for the subdimensions Paranoia, Grandiosity, and Paranormal beliefs.

Distress. Associations between frequency score and distress score were different for the 5 dimensions, controlling for age and sex (table 5). Associations between frequency score of Hallucinations, Delusions, and Paranoia on the one hand with distress score on the other did not differ from each other (data not shown), but were all higher than the associations between distress score and Grandiosity frequency score (respectively, $F_{1,874} = 216.81$; $P < .001$; $F_{1,874} = 164.24$, $P < .001$; and $F_{1,874} = 155.95$, $P < .001$) and the associations between distress score and Paranormal frequency score (respectively, $F_{1,874} = 205.00$; $P < .001$; $F_{1,874} = 164.45$, $P < .001$; and $F_{1,874} = 157.23$, $P < .001$). Regression coefficients for Grandiosity and Paranormal beliefs were not significantly different from each other ($F_{1,394} = 0.16$, $P < .69$).

Study 2: Tracking Adolescents' Individual Lives Survey

Methods

Participants. Tracking Adolescents' Individual Lives Survey (TRAILS) is a prospective cohort study among adolescents in the general Dutch population, investigating the development of mental and physical health from preadolescence into adulthood.³⁵ Three data collection waves have been completed: T1 (2001–2002), T2 (2003–2004), and T3 (2005–2007).

Of all individuals asked to participate in TRAILS ($N = 2935$), 76% agreed to participate at T1 ($N = 2230$; mean age 11.1 years; SD 0.6; 51% girls). Nonresponders did not

Table 3. Correlations Between the 5 CAPE Subdimension Item Scores and the 4 Subscales of the SDQ in the Health Behavior in School-Aged Children Study ($n = 5422$)

CAPE SDQ	Hallucinations	Delusions	Paranoia	Grandiosity	Paranormal Beliefs	CAPE Item Score
Hyperactivity	0.44 ^{a,d,e}	0.44 ^{a,d,e}	0.45 ^{a,d,e}	0.18 ^{a,b,c,e}	0.29 ^{a,b,c,d}	0.43 [*]
Emotional problems	0.64 ^{a,b,c,d,e}	0.68 ^{a,c,d,e}	0.78 ^{a,b,d,e}	0.34 ^{a,b,c,e}	0.55 ^{a,b,c,d}	0.69 [*]
Conduct problems	0.64 ^{a,d,e}	0.64 ^{a,d,e}	0.63 ^{a,d,e}	0.45 ^{a,b,c}	0.46 ^{a,b,c}	0.68 [*]
Peer problems	0.55 ^{a,b,c,d,e}	0.58 ^{a,c,d,e}	0.68 ^{a,b,d,e}	0.45 ^{a,b,c}	0.45 ^{a,b,c}	0.64 [*]

Note: ^{*} $P < .01$. CAPE, Community Assessment of Psychic Experiences; SDQ, Strengths and Difficulties Questionnaire.

^aDiffers from the correlation of this SDQ subscale with Hallucinations ($P < .001$).

^bDiffers from the correlation of this SDQ subscale with Delusions ($P < .001$).

^cDiffers from the correlation of this SDQ subscale with Paranoia ($P < .001$).

^dDiffers from the correlation of this SDQ subscale with Grandiosity ($P < .001$).

^eDiffers from the correlation of this SDQ subscale with Paranormal beliefs ($P < .001$).

Table 4. Mean CAPE Item Score and CAPE Subdimension Item Scores by Age and Sex and Statistics for Differences in Item Scores by Sex and Age in Health Behavior in School-Aged Children Study ($n = 5422$)

Dimension	Boys						Girls						Sex										
	12		13		14		15		16		12		13		14		15		16		F	df	P
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD					
Hallucinations	0.66 (1.0)	0.43 (0.8)	0.40 (0.4)	0.38 (0.8)	0.35 (0.7)	0.60 (0.9)	0.56 (0.9)	0.53 (0.9)	0.52 (0.9)	0.53 (0.8)	0.60 (0.9)	1.80 (1.9)	1.78 (1.9)	1.74 (1.9)	1.90 (1.9)	1.90 (1.9)	2.17 (2.2)	0.99	4	.001	15.62	1	.001
Delusions	1.62 (1.8)	1.54 (1.8)	1.58 (1.9)	1.52 (1.8)	1.52 (1.7)	1.80 (1.9)	1.78 (1.9)	1.74 (1.9)	1.90 (1.9)	2.17 (2.2)	1.80 (1.9)	2.87 (1.6)	3.07 (1.5)	3.17 (1.4)	3.23 (1.4)	3.46 (1.2)	10.16	4	.001	170.00	1	.001	
Paranoia	2.44 (1.6)	2.43 (1.5)	2.47 (1.6)	2.71 (1.5)	2.75 (1.5)	2.87 (1.6)	3.07 (1.5)	3.17 (1.4)	3.23 (1.4)	3.46 (1.2)	2.87 (1.6)	0.50 (0.7)	0.53 (0.7)	0.54 (0.7)	0.61 (0.8)	0.77 (0.8)	6.45	4	.001	33.34	1	.001	
Grandiosity	0.70 (0.8)	0.63 (0.8)	0.79 (0.8)	0.75 (0.8)	0.78 (0.8)	0.50 (0.7)	0.53 (0.7)	0.54 (0.7)	0.61 (0.8)	0.77 (0.8)	0.50 (0.7)	0.67 (0.8)	0.71 (0.8)	0.89 (0.8)	0.92 (0.8)	1.01 (0.8)	10.98	4	.001	142.42	1	.001	
Paranormal	0.50 (0.7)	0.51 (0.7)	0.58 (0.8)	0.57 (0.8)	0.59 (0.8)	0.67 (0.8)	0.71 (0.8)	0.89 (0.8)	0.92 (0.8)	1.01 (0.8)	0.67 (0.8)	6.44 (4.2)	6.65 (4.1)	6.88 (3.9)	7.18 (4.0)	7.94 (4.1)	4.71	4	.001	84.91	1	.001	
Any CAPE experience	5.93 (4.3)	5.54 (4.0)	5.83 (4.3)	5.93 (4.1)	5.99 (3.8)	6.44 (4.2)	6.65 (4.1)	6.88 (3.9)	7.18 (4.0)	7.94 (4.1)	6.44 (4.2)	6.65 (4.1)	6.88 (3.9)	7.18 (4.0)	7.94 (4.1)	84.91	1	.001	84.91	1	.001		

Note: Note that not every subdimension has an equal number of items; therefore, maximum item scores differ per subdimension. CAPE, Community Assessment of Psychic Experiences.

Table 5. Regression Coefficients of Association Between Frequency and Distress Within Dimensions in Health Behavior in School-Aged Children Study ($n = 5422$)

Dimension	β
Hallucinations	0.759*
Delusions	0.643*
Paranoia	0.682*
Grandiosity	0.199*
Paranormal beliefs	0.212*

* $P < .001$.

differ from responders in terms of psychopathology or in associations between individual characteristics and psychopathology. More detailed information on the selection procedures and nonresponse can be found elsewhere.³⁵ T3 was completed with 81% of the original number of participants ($N = 1816$), at a mean age of 16.3 years (SD 0.7), of whom 52% were girls.

Instruments. The 20 items of the CAPE positive dimension were used to assess psychotic experiences. Validity of subdimensions representing a continuum of psychopathology was assessed by correlating the dimensions with the subscales Internalizing problems, Externalizing problems, and Thought problems of the Youth Self Report (YSR), a screening instrument for youth general psychopathology.³⁶ The Thought problems subscale includes items like seeing or hearing things that other people do not see or hear, having thoughts that other people would find strange, and being unable to get thoughts out of one's head. Data on both CAPE and YSR were collected at T3.

Statistical Analyses. Model Replication and Convergent Validity An attempt was made to replicate the model observed in Study 1 with CFA and to compare it with 4 other models reported in the literature. Thus, 5 competing models were tested: a general 1-factor model, a 3-factor model reported by Yung and colleagues,¹⁸ a 4-factor model described by Stefanis and colleagues,¹⁷ another 4-factor model described by Yung and colleagues,¹⁵ and the 5-factor model that was developed in study 1. Again, data were ordinal and WLS was used for model estimation.³³ Validity of the subdimensions in terms of a continuum of psychopathology was assessed by correlating the dimensions of the extended psychosis phenotype with subscales of the YSR. Correlation coefficients were compared statistically as described by Meng and colleagues.³⁴

An age effect was not investigated because the age range at T3 (15–17 years) was too narrow. Associations

Table 6. Fit Indices of the 5 Competing Models in Tracking Adolescents' Individual Lives Survey ($n = 2230$)

Models With Number of Factors	Fit Index			
	χ^2	df	CFI	RMSEA
1 factor	829.28	107	0.78	0.064
3 factors	578.63	89	0.85	0.058
4 factors (Stefanis et al. ¹⁷)	632.44	106	0.84	0.055
4 factors (Yung et al. ¹⁵)	590.88	106	0.85	0.053
5 factors	352.28	105	0.92	0.038

Note: Note that Yung and colleagues¹⁵ used 18 of 20 positive Community Assessment of Psychic Experiences items for the 3-factor model; therefore, the df is lower in this model. CFI, Comparative Fit Index; RMSEA, Root Mean Square Error of Approximation.

between frequency of experiences and distress were assessed similarly as in study 1.

Results

Descriptives. In all, 94% of the participants endorsed at least one CAPE experience at least “sometimes.” In all, 39% endorsed at least one experience “often” or “nearly always.” The median CAPE item score was 4 experiences (IQR 2–6), and the 90th percentile was 9 experiences. Internal consistency of the positive items was excellent (Cronbach alpha = 0.93).

Model Replication. Analyses were conducted in Mplus.³⁷ CFA was used to test the 5 competing models. Several fit indices were compared to see which model fitted best. With the highest CFI and the lowest χ^2 and RMSEA (table 6), the 5-factor model was superior to the other models. Correlations between factors were comparable with those of study 1. In table 7, prevalences of the factors are shown at broad (ever vs never) and narrow (never/sometimes vs often/nearly always) level.

Table 7. Broad and Narrow Prevalence Rates of Subdimensions in Tracking Adolescents' Individual Lives Survey ($n = 2230$)

Dimension	Prevalence Rate “Ever”	Prevalence Rate “Often”/“Almost Always”
Hallucinations	13.7	1.8
Delusions	51.3	9.3
Paranoia	89.8	25.5
Grandiosity	40.8	7.7
Paranormal beliefs	46.6	13.3
Any CAPE experience	93.7	38.5

Note: CAPE, Community Assessment of Psychic Experiences.

Convergent Validity With General Psychopathology. In order to investigate the association between CAPE subdimension item scores and general measures of psychopathology, correlation coefficients were computed with 3 of the subscales of the YSR (Thought problems, Internalizing problems, and Externalizing problems) (table 8). Substantial correlations were found for Hallucinations, Delusions, and Paranoia with Internalizing problems ($r = 0.49$ – 0.70) and Externalizing problems ($r = 0.51$ – 0.75) and particularly Thought problems ($r = 0.80$ – 0.92). Grandiosity and Paranormal beliefs had consistently lower correlation coefficients with Internalizing ($r = 0.29$ and 0.30), Externalizing ($r = 0.26$ and 0.30) and Thought problems ($r = 0.60$ and 0.66).

Within the YSR subscales, a similar pattern was seen. Thought problems was associated more strongly with Paranoia, Delusions, and Hallucinations than with Grandiosity (respectively, $Z = 16.02$, $P < .001$; $Z = 23.63$, $P < .001$; and $Z = 37.09$, $P < .001$) or Paranormal beliefs (respectively, $Z = 11.85$, $P < .001$; $Z = 18.52$, $P < .001$; and $Z = 32.88$, $P < .001$). Similarly, Internalizing problems were associated more strongly with Paranoia, Hallucinations, and Delusions than with Grandiosity (respectively, $Z = 23.32$, $P < .001$; $Z = 20.32$, $P < .001$ and $Z = 12.02$, $P < .001$) and Paranormal beliefs (respectively, $Z = 23.21$, $P < .001$; $Z = 21.34$, $P < .001$ and $Z = 10.65$, $P < .001$). Externalizing problems were also associated more strongly with Paranoia, Hallucinations, and Delusions than with Grandiosity (respectively, $Z = 28.45$, $P < .001$; $Z = 19.93$, $P < .001$; and $Z = 15.03$, $P < .001$) and Paranormal beliefs (respectively, $Z = 26.75$, $P < .001$; $Z = 17.64$, $P < .001$; and $Z = 11.51$, $P < .001$).

Sex. Girls had higher CAPE item scores than boys and similarly displayed higher CAPE subdimensions item scores on all subdimensions, except for Grandiosity, on which boys scored higher (table 9). The mean CAPE item score and CAPE subdimension item scores are also shown in table 9.

Distress. Associations between frequency score and distress score were different for the 5 dimensions, controlling for age and sex (table 10). Again, associations between frequency score of Hallucinations, Delusions, and Paranoia on the one hand with distress score on the other did not differ from each other (data not shown), but were all higher than the associations between distress score and Grandiosity frequency score (respectively, $F_{1,394} = 55.99$, $P < .001$; $F_{1,394} = 33.40$, $P < .001$; and $F_{1,394} = 55.77$, $P < .001$) and the association between distress score and Paranormal beliefs frequency score (respectively, $F_{1,394} = 93.81$, $P < .001$; $F_{1,394} = 46.62$, $P < .001$; and $F_{1,394} = 73.87$, $P > .001$). Regression coefficients for Grandiosity and Paranormal beliefs were not significantly different from each other ($F_{1,394} = 0.89$, $P < .30$).

Table 8. Correlations Between the 5 CAPE Subdimension Item Scores and 3 Subscales of the YSR in Tracking Adolescents’ Individual Lives Survey (*n* = 2230)

CAPE YSR	Hallucinations	Delusions	Paranoia	Grandiosity	Paranormal Beliefs	CAPE Item Score
Thought problems	0.92*.b,c,d,e	0.85*.a,c,d,e	0.80*.a,b,d,e	0.60*.a,b,c,e	0.66*.a,b,c,d	0.89*
Internalizing problems	0.62*.b,c,d,e	0.49*.a,c,d,e	0.70*.a,b,d,e	0.29*.a,b,c	0.30*.a,b,c	0.59*
Externalizing problems	0.59*.b,c,d,e	0.51*.a,c,d,e	0.75*.a,b,d,e	0.26*.a,b,c	0.30*.a,b,c	0.60*

Note: **P* < .01. CAPE, Community Assessment of Psychic Experiences; YSR, Youth Self Report.

^aDiffers from the correlation of this YSR subscale with Hallucinations (*P* < .001).

^bDiffers from the correlation of this YSR subscale with Delusions (*P* < .001).

^cDiffers from the correlation of this YSR subscale with Paranoia (*P* < .001).

^dDiffers from the correlation of this YSR subscale with Grandiosity (*P* < .001).

^eDiffers from the correlation of this YSR subscale with Paranormal beliefs (*P* < .001).

Discussion

The extended psychosis phenotype can be readily assessed in early adolescence, as the majority of adolescents in 2 large, independent general population samples (respectively, 95% and 94%) endorsed at least one positive psychotic experience at least “sometimes” with medians of, respectively, 4 and 6 endorsements. In addition, respectively, 43% and 39% endorsed at least one experience at the level of “often” or “nearly always.” An underlying structure of 5 different subdimensions was found, labeled Hallucinations, Delusions, Paranoia, Grandiosity, and Paranormal beliefs. Girls reported more experiences than boys, with the exception of Grandiosity; an increase of experiences between the ages of 12 and 16 years was apparent. Of the 5 subdimensions, Hallucinations, Delusions, and Paranoia showed the strongest associations with distress and general measures of youth psychopathology.

Whereas the prevalence of psychotic experiences in the general adult population is quite high,^{12,28,38–40} prevalence is even higher during adolescence. Prevalences in

the present study are higher than prevalences reported by Yung and colleagues¹⁵ when examined at the broad level contrasting occurrence of “ever” vs “never.” In fact, prevalences at the narrow level of “often”/“nearly always” in the current samples are comparable to the prevalence at the broad level reported by Yung and colleagues.¹⁵ However, the broadly defined prevalence in the current studies match the similarly broadly defined prevalence reported by Yung and colleagues in a nonpsychotic clinical sample of adolescents aged 15 years (*N* = 140),¹⁸ nearly 100% of which reported at least one positive psychotic experience. The broadly defined prevalence in the current studies also match the prevalence of hallucinatory experiences in an adolescent general population reported by Scott and colleagues.⁷ Converging results therefore indicate that positive psychotic experiences are quite common during adolescence, not only in clinical but also in general population samples.

Several explanations for the finding of high rates can be brought to bear. Adolescents may in general be more self-conscious than adults; this could make them more susceptible to certain (paranoid) thoughts and perceptions.⁴¹ Furthermore, it is more difficult for adolescents to distinguish between relevant and irrelevant stimuli than it is for adults⁴²; this could result in extrasensory perceptions, such as hallucinations.

Table 9. Mean CAPE Item Score and CAPE Subdimension Item Score by Sex and Statistics on Sex Differences in Item Scores in Tracking Adolescents’ Individual Lives Survey (*n* = 2230)

Dimension	Sex		<i>F</i>	df	<i>P</i>
	Boys	Girls			
Hallucinations	0.15 (0.5)	0.23 (0.6)	8.74	1	.003
Delusions	0.91 (0.5)	1.12 (1.4)	9.40	1	.002
Paranoia	1.91 (1.3)	2.48 (1.3)	80.42	1	.001
Grandiosity	0.62 (0.8)	0.51 (0.7)	10.91	1	.001
Paranormal	0.51 (0.7)	0.82 (0.8)	56.69	1	.001
Any CAPE experience	4.12 (3.1)	5.15 (3.2)	42.65	1	.001

Note: Note that not every subdimension has an equal number of items; therefore, maximum item scores differ per subdimension. CAPE, Community Assessment of Psychic Experiences.

Table 10. Regression Coefficients of Association Between Frequency and Distress Within Dimensions in Tracking Adolescents’ Individual Lives Survey (*n* = 2230)

Dimension	β
Hallucinations	0.625**
Delusions	0.642**
Paranoia	0.689**
Grandiosity	0.143**
Paranormal beliefs	0.094*

***P* < .001.

**P* < .005.

Given that nonclinical psychotic experiences are so highly prevalent among adolescents, a necessarily weak relationship can be inferred with later psychotic disorder.¹⁰ Therefore, the underlying structure of positive experiences was further investigated. A model with 5 dimensions was found to describe the data best. These dimensions are comparable with those reported by Verdoux and colleagues, who found 7 delusional dimensions in a sample aged 19–95 years.⁵ Although items on religiosity and apocalyptic ideas were not included in the CAPE and items on hallucinations were not included in the study by Verdoux and colleagues, their remaining dimensions (Persecution, Thought Disturbances, Grandiosity, Paranormal beliefs, and feelings of Reference-Guilt) are quite similar to the dimensions analyzed in the current report. Furthermore, the dimensions reported by Stefanis and colleagues¹⁷ (Paranoia, First rank symptoms, Hallucinations, and Grandiosity), Yung and colleagues¹⁸ (Bizarre experiences, Persecutory ideas, and Magical thinking) and Yung and colleagues¹⁵ (Bizarre experiences, Perceptual abnormalities, Persecutory ideas and Magical thinking) are also conceptually comparable, the difference being that Paranormal beliefs was not reported by Stefanis and colleagues,¹⁷ whereas Hallucinations and Delusions were grouped into a single dimension and Grandiosity and Paranormal beliefs into another in the study by Yung and colleagues.¹⁸ Grandiosity and Paranormal beliefs were also grouped into one dimension by Yung and colleagues.¹⁵ These studies together suggest (a) a similar underlying structure of mild positive psychotic experiences across different age groups and (b) a possible lifelong stability of this structure.

Despite the fact that the 5 dimensions were correlated, the data suggest that it is useful to make a distinction between them. First, correlations between dimensions were substantial, but not perfect (ie, not all above 0.80), suggesting partly different underlying mechanisms. Second, prevalences of the dimensions differed strongly, also as a function of gender and age. Third, the association between frequency and distress differed over the dimensions. Fourth, the dimensions correlated differently with screening instruments for general youth psychopathology. Fifth, literature suggests that different dimensions may be related to different risk factors; eg, trauma may be associated with hallucinations⁴³ and social stressors with paranoia.⁴⁴ This all suggests that the dimensions truly represent partly different constructs.

Prevalence patterns in the dimensions were similar over the 2 samples, supporting the robustness of our findings. Experiences of Paranoia were reported the most and Hallucinations the least frequently. Prevalences of Delusions, Grandiosity, and Paranormal beliefs were in between, in relatively comparable numbers. These patterns are comparable with those reported by Yung and colleagues¹⁸ and replicate their findings in a general population

sample. The finding that girls reported somewhat more positive experiences than boys (96% vs 93% and 96% vs 91%) and in particular Paranormal beliefs, is in agreement with the literature.^{23,39,45} Boys reported higher levels of Grandiosity, replicating the finding reported by Verdoux and colleagues⁵ in adult men. In line with Fonseca-Pedrero and colleagues,⁶ our findings indicate that these sex-specific patterns are already present in an adolescent sample aged 12–16 years. This phenomenon matches the finding that the overall mental health (especially internalizing problems) of girls seems to deteriorate over the course of adolescence: With age, girls report increasing levels of psychological and psychosomatic problems⁴⁶ and increased sensitivity to stressors.⁴⁷ Thus, the findings agree with the large body of literature, suggesting that adolescence may be a more stressful time for girls than for boys. Another explanation, however, may be that the higher level of positive experiences in girls may represent affect-driven changes in salience, secondary to higher rates of mood symptoms in girls.⁴⁸ However, because girls do not score higher on every single subdimension, affective dysregulation may not account for the entire effect of female sex.

CAPE questions were phrased as “Have you ever...” and thus refer to lifetime cumulative incidence. Therefore, the observed age effects may be difficult to interpret, as it is not known at what age the reported experiences occurred. However, it can be inferred that the data indicate that increasing age is associated with increasing level of psychotic experiences: If this were not the case, then 16-year olds would have to have the same level of experiences as 12-year olds, unless highly unlikely scenarios are assumed. The effect of age was observed over a relatively narrow age span of 5 years, suggesting that cohort effects cannot explain this finding, because 5 years is too narrow a span to encompass 2 cohorts. Therefore, the conclusion that levels of mild psychotic experiences indeed increase with age in early adolescence appears to be valid.

It was hypothesized that not all dimensions may be equally predictive of later psychopathology and that this would show as differential associations with distress and general psychopathology.¹⁹ The present results show that the relation between frequency of experiences and distress associated with the experiences is the strongest for Hallucinations, Delusions, and Paranoia. Although Yung and colleagues¹⁸ found higher correlation coefficients between frequency and distress (likely because they studied a clinical sample), the patterns are again comparable: Strong associations with distress were found for Bizarre experiences and Persecutory ideas and a weaker association with Magical thinking. In addition, the 5 subdimensions correlated differently with several subscales of 2 general measures of youth psychopathology. Hallucinations, Delusions, and Paranoia were associated more strongly with all subscales

of both measures than Grandiosity and Paranormal beliefs.

Based on these findings, the 5 subdimensions may be subdivided into 2 groups. One group represents the “core” dimensions of the extended psychosis phenotype, ie, Hallucinations, Delusions, and Paranoia, tapping into a continuum with more severe psychopathology, given the fact that they are associated more strongly with distress and general psychopathology. Another group represents cognitive experiences of Grandiosity and Paranormal beliefs, which may not form part of the extended psychosis phenotype in its continuity with severe mental illness.

The results should be interpreted in the context of the strengths and limitations of this study. One of the strengths is that the model was developed and replicated in 2 independent samples with a large number of representative school children. Recruitment and assessment of participants in schools may have had some disadvantages, such as the presence of peers and interviewers. However, this method also has some strong advantages: It is more anonymous, leads to lower nonresponse, and high-risk groups are better represented than in household surveys.⁴⁶ A weakness is that our study did not use clinical interviews for assessment. However, previous studies have shown that mild positive psychotic experiences can be reliably investigated by both self-report and interviews by clinicians, although self-report inevitably will generate more random error.⁴⁹ Another problem with self-report is the possibility that adolescents misinterpreted CAPE questions; however, a pilot study suggested that the CAPE is valid to use in an adolescent population and further, research assistants were present at the moment of administration to offer clarification if desired. Finally, the Grandiosity and Paranormal dimension were indexed by only 2 items each, which may limit their use as distinct psychometric assessment scales and may result in less stable estimates compared with the other factors. Ideally, latent factors should be defined by at least 3 indicators, to avoid, eg, model underidentification.³³ However, the fact that these 2 dimensions were identified across 2 different samples, showed good model fit, as well as high factor loadings, supports their validity. Further studies should focus on optimizing assessment of these 2 dimensions.

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