



Psychotic experiences and trauma predict persistence of psychosocial problems in adolescence

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Abstract

Psychosocial problems during adolescence are heterogenic, rather common, and unstable. At the same time, they are associated with an elevated risk of developing psychiatric disorders later in life. We aimed to describe the trajectories of psychosocial problems during adolescence and examine potential markers of persistence as compared to remission of these problems. At baseline, 1841 adolescents (51.4% female) were included. Of these adolescents, 1512 (mean age = 12.6 [range 11–14 years]; 52.8% female) completed the first and second self-report questionnaires on psychosocial problems (measured with the Strengths and Difficulties Questionnaire), psychotic experiences, trauma, self-esteem and somatic symptoms at two time points over a 1-year period. Regression analyses were used to examine the association between potential predictors and the trajectory of psychosocial problems (remitting versus persistent). Four trajectories were distinguished: 75.6% of the sample showed no problems (the ‘none’ trajectory), 11.9% were in a ‘remitting’ trajectory, 9.7% were in an ‘incident’ trajectory and 2.8% were in the ‘persistent’ trajectory. Hallucinatory experiences and trauma at baseline were significantly associated with persistence of psychosocial problems compared to those with remitting psychosocial problems. Low rather than high self-esteem was associated with lower risk for persistent problems. Risk of persistence of psychosocial problems increased with accumulation of predictors. Psychotic, especially hallucinatory, experiences and trauma predict persistence of psychosocial problems in adolescents. This underlines the need to assess psychotic experiences and trauma in mental health screening programs.

Keywords Psychosocial problems · Psychotic experiences · Trauma · Early detection

Introduction

Seventy-five percent of all severe psychiatric disorders (commonly defined as disorders with a chronic trajectory and substantially impaired functioning) emerge in adolescence or early adulthood [1]. Adolescence is therefore an important time to identify early signs and symptoms [2], as intervention at an early stage can be effective in minimising

the risk for an unfavourable trajectory of psychiatric disorders [3, 4].

It is difficult, however, to identify which adolescents are at risk for developing a severe psychiatric disorder. The first signs of these disorders in adolescence are often nonspecific; they present as a wide range of psychosocial problems that are often self-limiting and transient [5]. A trajectory of persistent or increasing psychosocial problems increases the likelihood that an adolescent is at an early stage of a psychiatric disorder [3, 6]. To identify a persistent trajectory of psychosocial problems, adolescents should be screened at least twice. A strategy of repeated screening for psychosocial problems, however, is cost heavy and time-consuming, and identifies at-risk adolescents only when signs and symptoms have already been present for a longer period of time, potentially leading to an unwanted delay and contributing to an unfavourable trajectory. This raises a question as to whether there is a way to predict the likelihood of persistence of psychosocial problems when they arise in a manner that is

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feasible and acceptable in a general population screening setting.

Previous studies have identified various factors that predict persistence of psychosocial problems in the general population [6–8]. A large, retrospective longitudinal Dutch study, for example, showed that trajectories of psychosocial problems are stable and can be predicted by early general developmental factors (e.g. maternal smoking during pregnancy) [9]. Data from the same study showed that baseline externalising or internalising of problems at age 11 predicted externalising and internalising disorders at age 19 years [10]. Thus far, however, no studies have distinguished a persistent trajectory from a remitting trajectory of symptoms.

Several factors have been associated with persistence of psychosocial problems and could function as predictive factors (markers) at an early stage. Subclinical psychotic symptoms may be a promising candidate as a marker for the persistence of psychosocial problems. The phenomenon of subclinical psychotic symptoms has received increased interest in recent decades. A review of Lee et al. [11] included 76 studies that used a variety of terms for subclinical psychotic symptoms (e.g. ‘psychotic-like experiences’, ‘unusual experiences’, ‘psychotic experiences’). In this study, we refer to subclinical psychotic symptoms as ‘psychotic experiences’ (‘subclinical hallucinations’ and ‘delusions’ are referred to as ‘hallucinatory experiences’ and ‘delusional experiences’, respectively). While previous studies have suggested that psychotic experiences are related to a psychotic disorder later in life [12], recent evidence has shown that these experiences in combination with impaired functioning may be a marker of risk of general psychopathology and may also predict an unfavourable trajectory of non-psychotic disorders [13]. A large longitudinal study in a general population sample (mean age 10.4) found that psychotic experiences predicted both internalising and externalising problems later in life [7].

Childhood trauma is another factor that is strongly associated with increased risk for various psychiatric disorders [14, 15]. Studies suggest that the association between childhood trauma and psychiatric disorders is often nonspecific; trauma is not only associated with full-blown psychiatric disorders, but also with symptoms of these disorders. A recent review and meta-analysis showed that childhood adverse life events, including trauma, are associated with persistence of psychotic experiences [16]. Considering its strong association with various disorders, trauma could also be considered a potential marker for persistence of psychosocial problems.

Low self-esteem has been repeatedly (although inconsistently) associated with various psychiatric disorders [17–19]. Self-esteem can be defined as the feeling of being a person of worth, being ‘good enough’ [20]. A meta-analytic study covering 95 longitudinal studies of depression and anxiety showed that low self-esteem predicts depression, and it also

seemed to be both a cause and consequence of anxiety disorders [21].

Somatic symptoms, as in body-related sensations that are perceived as unpleasant or painful, are frequently reported by adolescents [22, 23], with fatigue, headaches, backaches, stomachaches and agitation among the most common. Somatic symptoms are linked to depression, anxiety and stress [24]. Several studies suggest that somatic symptoms in adolescence can predict severe psychiatric disorders in adulthood [25, 26].

As a result, this study focused on psychotic experiences, trauma, self-esteem and somatic symptoms as potential markers associated with persistence of psychosocial problems. Research shows that the explained variance of most markers for persistence of psychopathology is low. A useful strategy may be to combine markers, as this may improve prediction models: for example, a study by Stilo et al. [27] examining the effect of cumulation of social disadvantage on risk for psychosis showed that the odds of psychosis increase in line with cumulation of disadvantage. Persistence of psychosocial problems may be more likely for adolescents if they have been exposed to more than one risk factor. Thus, this study examined the effect of the accumulation of markers on the persistence of psychosocial problems. Since it may instead be the accumulation of markers that heightens the risk of persistence, a cumulative risk score of risk factors could differentiate children at high risk for persistent psychosocial problems from their peers with a low risk for persistent psychosocial problems [28].

This study aimed to examine markers of persistence of psychosocial problems versus remitting psychosocial problems using two consecutive mental health screening assessments in a school-based population. We assessed (1) the prevalence of the various trajectories of psychosocial problems, (2) markers of persistence of psychosocial problems compared to remitting psychosocial problems and (3) whether an accumulation of predictive markers increases the risk for persistence of psychosocial problems.

Method

This study is part of the MasterMind project, a longitudinal school-based screening study of adolescent mental health in the Netherlands [29]. Longitudinal data were collected at two assessments, with 12 months between the assessments. A total of 13 schools consisting of 96 first-grade classes participated in this study. Participating schools were located in various parts of the Netherlands, but most were based in urban agglomerations. The schools had various educational levels: lower vocational educational level, higher secondary educational level and pre-university educational level. For the first assessment, providing baseline data, a total number

of 2148 adolescents were selected. The second assessment, providing follow-up data, took place 1 year after the baseline assessment (see Fig. 1). The total sample consisted of 1512 adolescents.

Procedure

Data were collected from June 2012 to January 2015. Approval for the study was granted by the Medical Ethics Committee of the VU University Medical Centre (reference number 2013.247). After we consulted with the school board, parents received a letter with information about the study and a passive consent form. During regular classes, students completed a web-based questionnaire under supervision of a researcher and research assistants.

Measures

Socio-demographic characteristics

Data on gender, age, education level, migrant background, parental divorce, repeating a class and moving history were collected using self-report questions.

Psychosocial problems

The self-report version of the Strengths and Difficulties Questionnaire (SDQ) [30] was used to screen for psychosocial problems in children and adolescents. The SDQ contains 25 items, investigating five domains: hyperactivity/

inattention, emotional problems, problems with peers, behavioural problems and prosocial behaviour. The answers to the statements are coded as follows: ‘not true’ = 0, ‘somewhat true’ = 1 and ‘certainly true’ = 2. A total score for psychosocial problems was calculated based on the four subscales: emotional problems, behaviour problems, hyperactivity and peer problems. The total score of the SDQ was dichotomised, representing risk for having a psychiatric disorder based on the UK norm score [31]: scores from 0 to 15 are considered normal (80% of the general adolescent population) and scores between 16 and 40 are considered heightened (20% of the general adolescent population).

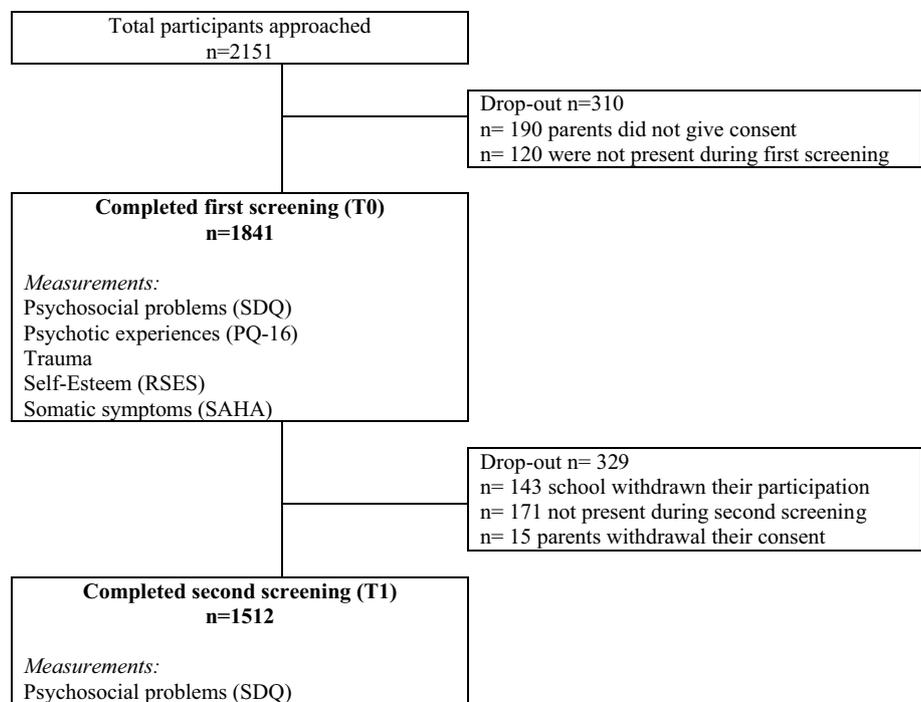
Trajectories of psychosocial problems were defined based on the SDQ. The *none trajectory* includes adolescents with no prosocial problems on both baseline and follow-up (SDQ score ≤ 15). The *remitting trajectory* includes adolescents with a high score (SDQ score > 15) on baseline and a low score (SDQ score ≤ 15) at follow-up. The *incident trajectory* includes adolescents with a low score (SDQ score ≤ 15) on baseline and a high score (SDQ score > 15) at follow-up. The *persistent trajectory* includes adolescents with high scores on both baseline and follow-up (SDQ score > 15).

Potential markers

Psychotic experiences

The 16-item version of the Prodromal Questionnaire (PQ-16 [29]) was used to identify psychotic experiences. The PQ-16 is validated in a non-psychotic help-seeking population [30]

Fig. 1 Flowchart and overview of the questionnaires filled out during T0 and T1



and in an adolescent sample [31]. The subscales ‘hallucinatory experiences’ (assessed by nine items, e.g. ‘I have heard things other people can’t hear, like voices of people whispering or talking’) and ‘delusional experiences’ (assessed by five items, e.g. ‘I have been confused at times whether something I experienced was real or imaginary’) were used in this study. Responses were made on a two-point scale (0 = not true, 1 = true). The items were followed by questions on distress (possible responses: 0—no distress, 1—mild distress, 2—moderate distress and 3—severe distress). An experience was classified as psychotic if it was associated with at least moderate distress. Sum scores were dichotomised into two categories: having no psychotic experiences and having at least one psychotic experience.

Trauma

Lifetime presence of trauma was assessed with six items derived from the PTSD section of the Diagnostic Interview Schedule for Children (DISC, [32]). The interview questions were transformed to self-report questions and previously used in a study by Adriaanse et al. [33]. The questionnaire assessed the following six traumatic events: (1) fear that someone close to you would be killed or seriously injured; (2) having been attacked, beaten up or threatened; (3) being forced to do something sexually; (4) having experienced a serious accident; (5) witnessing a situation in which someone close to you was killed or seriously injured and (6) seeing a dead person or seeing a dead person whom you had known well. Each experience was coded for presence (1) or absence (0). Each traumatic experience was followed by a question asking when it had occurred. Since traumatic experiences were measured only at the second assessment and we wanted to use trauma as a predictor variable, we classified a traumatic experience as present only if participants reported that it had happened before the baseline assessment. As a further requirement for traumatic experience, participants were asked if they had thought about that trauma regularly during the last month (no = 0, yes = 1). An item was only coded as present when a participant had thought about the experience regularly during the last month. The sum score of the six questions was dichotomised into two categories: reporting no trauma and reporting at least one trauma.

Self-esteem

The Rosenberg Self-Esteem Scale (RSES [34]; Dutch translation [35]) is a 10-item scale measuring self-esteem on a four-point Likert scale (0 = strongly agree to 3 = strongly disagree). The sum score was dichotomised into two categories: having a low self-esteem (sum score < 15) and having a moderate or high self-esteem (sum score ≥ 15). High self-esteem was coded as 0 and low self-esteem as 1.

Somatic symptoms

The Social and Health Assessment (SAHA) is a self-report instrument used to measure psychopathology and risky behaviour in adolescence [36]. The ‘somatic complaints’ section consists of ten items with a three-point scale (0 = not true, 1 = a bit true, 2 = true) measuring somatic complaints such as headache, stomachache and sleeping problems. To create dichotomous scores, we used the same 80–20% rule that was used to create the published SDQ cutoff scores. The sum score was used to create two categories: having no or few somatic symptoms (80% of the general adolescent population; sum score ≤ 4) and having at least moderate somatic symptoms (20% of the general adolescent population; sum score > 4).

Statistical analyses

Descriptive data were analysed using the Statistical Package for the Social Sciences, Version 20 (SPSS Inc., Chicago, IL, USA). Statistical significance was considered at $p \leq 0.05$. Chi square analysis and one-way analysis of variance (ANOVA) were used to examine differences in social demographics between the four trajectories.

To examine which variables predict persistence of psychosocial problems compared to remitting psychosocial problems, a series of logistic regression analyses was performed, using ‘remitting trajectory’ as a reference category. The dependent variable was ‘trajectory of psychosocial problems’ with the options ‘remitting’ and ‘persistent’, and the independent variable was ‘psychotic experiences’ (with a subdivision of ‘hallucinatory experiences’ and ‘delusional experiences’), trauma, self-esteem and somatic symptoms at baseline. In these analyses, the continuous sum scores were used.

The association between accumulation of predictive markers and persistence of psychosocial problems was examined with a logistic regression analysis. First, a cumulative marker score was calculated based on the dichotomised sum scores of the variables: a score of 1 was assigned to the presence of each variable that was significantly associated with a persistent trajectory of psychosocial problems. These markers of persistence were subsequently summed into one score. This sum score was the independent variable in the logistic regression with ‘trajectory of psychosocial problems’ as the dependent variable. All regression models controlled for gender and educational level.

Results

Of the 1512 adolescents with data from both time points, the largest group was the none trajectory group (75.6%), characterised by low levels of psychosocial problems at both

baseline and 1 year later. The remitting trajectory, consisting of the adolescents reporting high levels of psychosocial problems at baseline and low levels of psychosocial problems 1 year later, was the second largest group (11.9%). The incident trajectory, characterised by low-level psychosocial problems at baseline and high-level psychosocial problems 1 year later, included 9.7% of the youths. Finally, 2.8% of the adolescents were in the persistent trajectory, characterised by high levels of psychosocial problems at both baseline and 1 year later.

The four trajectories did not differ in age and gender. The proportion of adolescents with a migrant background was larger in the incident' group than in the none group. Lower vocational educational levels were more prevalent in the remitting group than in the none group. Having divorced parents, having repeated a class and frequent relocations were more present in the remitting group than the none and incident groups (see Table 1).

Markers of a persistent trajectory

Table 2 shows an overview of mean scores for psychosocial problems, psychotic experiences, somatic symptoms, self-esteem and trauma for each trajectory group.

In Table 3, the prevalence of markers (dichotomised) is shown. Compared to adolescents in the remitting trajectory, adolescents with persistent psychosocial problems did not report more overall psychotic experiences at baseline than those with remitting problems ($\chi^2(1)=3.19, p=0.07$). However, adolescents in the persistent group did report more hallucinatory experiences than those with remitting problems ($\chi^2(1)=9.28, p=0.002$). Similar results were found for trauma: those with persistent psychosocial problems reported more trauma than those with remitting psychosocial problems ($\chi^2(1)=7.59, p=0.006$). A reverse difference

was found for low self-esteem; adolescents with remitting psychosocial problems more frequently reported lower self-esteem compared to those with persistent psychosocial problems ($\chi^2(1)=3.68, p=0.05$). No differences were found for somatic symptoms ($\chi^2(1)=0.03, p=0.96$; see Table 3).

Table 4 summarises the results of the logistic regression analyses (adjusted for gender and educational level), which evaluated potential predictive factors for persistence of symptoms. Hallucinatory experiences were related to almost three times higher odds of persistent psychosocial problems than remitting psychosocial problems ($p=0.002$). Delusional experiences showed no significant association with persistence of psychosocial problems. Traumatic experiences correlated to a 2.3 times higher risk of persistent psychosocial problems than remitting psychosocial problems ($p=0.02$). Low self-esteem was not associated with persistence of problems, but instead with a 0.4 times lower risk of persistent psychosocial problems than remitting psychosocial problems. Reporting somatic symptoms showed no higher odds of persistent psychosocial problems than remitting psychosocial problems.

Accumulation of markers for a persistent trajectory

As only hallucinatory experiences and trauma were associated with persistence of psychosocial problems, the cumulative variable of markers ranged from 0 to 2. The presence of one predictive marker was associated with two times higher odds of the persistence trajectory compared to the remitting trajectory (OR 2.31, 95% CI 1.24–4.74, $p=0.02$). The presence of two predictive markers was associated with a six times higher risk of persistent problems compared to remitting problems (OR 6.35, 95% CI 2.39–16.91, $p<0.01$).

Table 1 Baseline characteristics of the sample ($N=1512$)

	None $n=1134$ (75.6%)	Incident $n=151$ (9.7%)	Remitting $n=181$ (11.9%)	Persistent $n=46$ (2.8%)	Group differences
Gender, (%) girl	52.2	52.8	55.7	56.9	$\chi^2(3)=1.31, ns$
Age, M (sd)	12.60 (0.63)	12.65 (0.67)	12.67 (0.65)	12.65 (0.63)	$F(3)=1.06, ns$
Migrant background, (%) yes	45	56.6	47.3	38.8	$\chi^2(3)=9.6, p=0.02$
Educational level, (%)					$\chi^2(6)=96.9, p<0.001$
Lower vocational	34.8	52.7	61.2	54.0	
General higher secondary	40.7	17.2	18.2	14.0	
Pre-university	24.4	30.2	20.6	32.0	
Divorced parents, (%) yes	24.9	18.5	38.2	31.4	$\chi^2(3)=23.8, p<0.001$
Moved often, (%) yes	15.1	13.5	22.8	19.6	$\chi^2(3)=9.7, p=0.02$
Repeat a class, (%) yes	19.9	22.5	31.1	29.4	$\chi^2(3)=15.7, p<0.01$

Table 2 Descriptive statistics (mean and SD) for psychosocial problems, psychotic experiences, somatic symptoms, self-esteem, trauma for baseline and follow-up per trajectory group

	None		Incident		Remitting		Persistent	
	T0	T1	T0	T1	T0	T1	T0	T1
Psychosocial problems (SDQ) [range 0–40]	7.73 (3.56)	7.95 (3.57)	7.35 (3.70)	17.93 (2.97)	18.02 (3.08)	7.93 (3.52)	18.35 (2.86)	17.82 (2.36)
Behavioural problems [range 0–10]	1.50 (1.22)	1.52 (1.27)	1.47 (1.30)	3.30 (1.78)	3.76 (1.90)	1.57 (1.78)	3.49 (1.58)	3.53 (1.69)
Emotional problems [range 0–10]	1.78 (1.62)	1.82 (1.71)	1.63 (1.62)	5.35 (2.32)	5.04 (2.12)	1.76 (1.82)	4.98 (2.21)	4.90(2.57)
Hyperactivity [range 0–10]	3.04 (2.07)	3.37 (2.19)	2.85 (2.20)	6.62 (1.97)	6.34 (2.15)	3.47 (2.02)	6.37 (1.87)	6.39 (1.69)
Peer problems [range 0–10]	1.42 (1.35)	1.24 (1.27)	1.39 (1.43)	2.65 (1.65)	2.88 (1.85)	1.12 (1.24)	3.51 (2.02)	3.00 (1.88)
Prosocial behaviour [range 0–10]	8.10 (1.61)	8.06 (1.73)	8.24 (1.63)	7.71 (1.86)	7.15 (1.93)	7.93 (1.66)	7.47 (1.72)	7.04 (2.44)
Psychotic experiences [range 0–16]	1.56 (2.69)	1.42 (2.76)	1.44 (2.47)	4.64 (4.51)	5.58 (5.21)	1.48 (2.40)	7.14 (6.29)	5.84 (4.63)
Hallucinatory experiences [range 0–9]	1.48 (1.71)	1.34 (1.70)	1.41 (1.76)	2.24 (1.78)	3.40 (2.19)	1.27 (1.56)	4.71 (2.46)	3.47 (1.56)
Delusional experiences [range 0–5]	1.27 (1.56)	1.21 (1.07)	1.11 (1.08)	2.17 (1.31)	2.09 (1.24)	1.25 (1.08)	2.69 (1.34)	2.28 (1.44)
Trauma ^a [range 0–6]	0.40 (0.74)	–	0.58 (0.91)	–	0.43 (0.77)	–	0.73 (1.06)	–
Self-esteem [range 0–30]	16.26 (3.85)	22.36 (4.87)	16.35 (3.84)	16.37 (5.25)	15.36 (3.52)	22.91 (4.92)	16.80 (3.66)	16.18 (5.87)
Somatic symptoms [range 0–10]	0.95 (1.65)	3.86 (4.22)	0.86 (1.32)	4.00 (4.29)	2.68 (2.61)	6.96 (5.13)	2.57 (2.31)	6.56 (5.47)

^aTraumatic experiences were measured retrospectively at the second assessment

Table 3 Prevalence (%) of potential markers (dichotomized) at baseline and follow-up per trajectory group

	None		Incident		Remitting		Persistent	
	T0	T1	T0	T1	T0	T1	T0	T1
Psychotic experiences	10.6	11.3	9.6	22.6	48.9	9.6	62.7	41.2
Hallucinatory experiences	7.3	7.2	7.1	16.3	35.6	6.4	58.8	25.5
Delusional experiences	5.7	6.1	5.6	14.8	33.8	5.0	43.1	29.4
Trauma ^a	16.3	–	23.7	–	17.8	–	33.7	–
Low self-esteem	33.3	6.1	33.1	32.6	44.1	4.6	29.4	39.2
Somatic symptoms	5.8	12.9	7.9	15.6	31.8	38.5	31.4	40.6

^aTraumatic experiences were measured retrospectively at the second assessment

Table 4 Predictors for a persistent trajectory

	OR (95% CI) ^a	Wald (<i>p</i>)
Psychotic experiences	1.92 (0.99–3.70)	3.73 (0.05)
Hallucinatory experiences	2.74 (1.45–5.20)	9.55 (0.00)
Delusional experiences	1.59 (0.84–3.00)	2.06 (0.15)
Trauma	2.30 (1.15–4.61)	5.56 (0.02)
Low self-esteem	0.44 (0.23–0.84)	6.25 (0.01)
Somatic complaints	0.99 (0.50–1.96)	0.00 (0.98)

Remitting trajectory is the reference group; regression analyses were done with separate analysis for each predictor

^aAdjusted for gender and educational level

Discussion

This longitudinal school-based study aimed to develop a basic screening strategy for identification of adolescents at risk for psychiatric disorders by testing the potential clinical and socio-demographic markers of a persistent trajectory of psychosocial problems. In a sample of 1512 adolescents aged between 11 and 14 years, 3% had persistent psychosocial problems at the 12-month follow-up, while in 12% psychosocial problems had remitted. Hallucinatory experiences and self-reported traumatic experiences at baseline predicted a persistent trajectory rather than a remitting trajectory. Risk

for a persistent trajectory increased with accumulation of these factors. Low self-esteem was associated with persistent psychosocial problems, but in a different direction than we expected. Somatic symptoms were not associated with a persistent trajectory of psychosocial problems.

The prevalence of a persistent trajectory in this sample was lower than in previous studies (e.g. 8), which reported a prevalence rate of approximately 17%. This may be related to differences in the demographic characteristics of the sample and differences in design. A study by Lancefield et al., for example, had a younger cohort (aged 9–13) and used a broader definition for the presence of psychosocial problems. Further, in this study, psychosocial problems were regarded as early expressions of psychopathology. The SDQ has been constructed as a screening instrument to assess risk of psychiatric disorders. Its items measure the signs and symptoms of (emerging) internalising and externalising disorders. Clinical staging models, such as those described and investigated by, among others, McGorry and van Os, suggest that persistent psychosocial problems in adolescence are an early expression of emerging psychopathology. These early expressions are described as being ‘dynamic’ and often arise in response to experiences in the social environment and interaction with biological changes. Over time, these expressions may develop into clusters of symptoms and eventually a more full-blown psychiatric disorder [37–39].

Hallucinatory experiences predicted a persistent trajectory of psychosocial problems. Prior research has shown that psychotic experiences are related to a broad range of mental health problems, including psychosocial problems, but most studies have investigated whether psychosocial problems predict psychotic experiences and not the other way around [6–8]. We tested psychotic experiences as a potential marker of persistent rather than transient mental health problems. As hallucinatory experiences differentiated between adolescents with remitting and persistent psychosocial problems—and persistent psychosocial problems in adolescence are related to the development of psychiatric disorders in adulthood—it can be argued that self-reported psychotic experiences are a valuable screening instrument for early identification of adolescents at risk for developing psychiatric disorders [10]. It should be noted that whereas hallucinatory experiences predicted a persistent trajectory, delusional experiences did not. The reasons for this difference remain unclear, but may be explained by measurement problems. Items on delusional experiences (e.g. ‘I often seem to live through events exactly as they happened before’) are more likely to be misinterpreted by adolescents than items on hallucinatory experiences (e.g. ‘I have seen things that other people can’t see or don’t seem to’). A recent study among 875 adolescents (mean age 15.6) found that particular subtypes of psychotic experiences, like perceptual abnormalities, are associated with more distress than other subtypes and

that not all psychotic experiences are an expression of an underlying vulnerability to psychopathology [37]. It may be that delusional experiences are less closely related to early psychopathology. These include items like ‘I often feel that others have it in for me’ and ‘I often seem to live through events exactly as they happened before’. These items may be more likely to be endorsed based on ‘normal’, ‘real’ situations than hallucinatory experiences that include items such as ‘I have heard things other people can’t hear, like voices of people whispering or talking’ and ‘I have seen things that other people can’t see or don’t seem to’.

As hypothesised, adolescents reporting traumatic experiences had a higher risk of persistent psychosocial problems compared to those without traumatic experiences. This is in line with previous studies reporting that traumatic experiences increase risk for psychiatric disorders [14, 15]. Early traumatic experiences can have a long-lasting influence on the development of mental health problems, as they may trigger the formation of negative cognitive schematic models about oneself and the world. Moreover, exposure to early childhood trauma may influence the sensitivity of the stress response system, which can lead to more vulnerability to stressful situations. Further, some studies suggest that traumatic experiences are not only related to the development of mental health problems, but may also be associated with the persistence of these symptoms (e.g. [40, 41]).

Contrary to our expectations, we found a reverse association between self-esteem and persistence of psychosocial problems: low, rather than high, self-esteem was associated with a decreased risk for a persistent trajectory compared to the remitting trajectory. Low levels of self-esteem have been implicated as both a cause and consequence of mental disorders; a study by Romm et al. [19] showed a significant relationship between low self-esteem and psychotic experiences. In our study, overall self-esteem mean scores in the different trajectories were above the cutoff score that indicated low self-esteem, and patterns over time were as expected (e.g. levels of self-esteem increased in adolescents with remitting problems and decreased in those with persistent problems). However, the remitting group had the lowest score at baseline and the highest self-esteem at the follow-up measurement. In their large longitudinal study examining the development of self-esteem from age 14 to 30 years, Erol et al. found that self-esteem changes strongly in adolescence [20]. Self-esteem is determined by many factors other than psychosocial problems. Low self-esteem may be related to psychosocial problems, but does not seem to be useful for predicting the persistence of these problems.

Accumulation of significant markers for a persistent trajectory of psychosocial problems showed a linear relationship with risk for a persistent trajectory (i.e. the risk for a persistent trajectory increased if adolescents had both hallucinatory experiences and trauma). This is in line with

previous studies showing an increased risk of psychosocial problems with accumulation of risk factors [28]. These findings suggest that screening including psychosocial problems, psychotic experiences and other associated risk factors encourages early identification of adolescents at risk for persistent problems. The SDQ is a widely used screening instrument in general child and adolescent populations assessing indications for psychiatric disorders; adding items on hallucinatory experiences and childhood trauma may improve the accuracy of the instrument.

These results should be seen in the light of their strengths and weaknesses. This is a large, longitudinal school-based study with a high response rate at baseline and follow-up. Most studies thus far have used designs in which those with persistent problems were compared to those reporting no psychosocial problems. Our study instead examined potential markers for a persistent trajectory by comparing adolescents with remitting psychosocial problems to those with persistent problems. Psychosocial problems are highly prevalent in adolescence, and are often self-limiting. To provide help for those who require it, is important to be able to distinguish between remitting and persistent different trajectories in the early stages of psychiatric disorders.

The findings of this study are subject to several limitations. First, the assessment of trauma was limited to assessing physical and sexual traumatic experiences. This means that experiences such as emotional neglect were not measured. Further, we measured traumatic experiences only at the second assessment and not at baseline. Although we included only traumatic events that had occurred before the baseline assessment, this increases the risk for information bias, since participants may have forgotten to report experiences or their details. Assessing traumatic events that took place prior to baseline, retrospectively at the second assessment, could have led to recall bias. Participants may forget to report experiences or details of their experiences when asked about them retrospectively. Furthermore, it is possible that trauma is better recalled by adolescents with a higher level of and more persistent psychosocial problems; a study by Colman et al. [42], for example, reported that the extent to which traumatic events are reported may be associated with factors related to current mental state. Second, for several of our questionnaires (such as the SAHA somatic complaints, PQ and self-esteem), a clinically meaningful cutoff point to indicate elevated scores was not available, which may have influenced the analysis of the cumulative predictor measure. Third, this study investigated psychotic experiences in an adolescent population, and prior research has shown that psychotic experiences are frequently reported in an adolescent general population, especially in younger adolescents. Kelleher et al. [43], for example, showed that the prevalence of psychotic experiences is lower in adolescents of 13–18 years (8%) compared to children of 9–12 years

(17%). Since these psychotic experiences are often transient, the question remains whether psychotic experiences can be used to identify those at risk for psychopathology. We tried to increase the clinical significance of the measure in this study by classifying psychotic experiences as such only if they were associated with at least moderate distress, as previous studies have shown that taking the impact of psychotic experiences into account increases their psychopathological significance [33, 44]. Further, although there are a few studies showing good validity of self-report measures of psychotic experiences in children and adolescents [45, 46], some questions about psychotic experiences may have been misinterpreted by some adolescents (e.g. the item ‘I feel that parts of my body have changed in some way, or that parts of my body are working differently’ could be interpreted as changing due to physical growth).

Finally, this study examined only two time points, which limits our knowledge about symptom levels 1 year before baseline or 1 year after follow-up. Studies using more time points may offer the opportunity to examine the stability of the trajectories.

In conclusion, our results suggest that early identification of adolescents with high risk for a persistent trajectory of psychosocial problems is feasible in a regular school setting. Whereas most screening programs for psychosocial problems in adolescence focus mainly on internalising and externalising problems, our findings underline the need for additional items concerning psychotic and traumatic experiences. This is despite the fact that psychotic experiences are often transient, and that it is not clear whether psychotic experiences themselves are an indicator for a psychiatric disorder. It may be that these experiences in combination with impaired functioning and the presence of other psychiatric symptoms are a marker of general psychopathology. Further, longitudinal studies investigating the association between emotional problems and psychotic experiences in adolescents have shown that emotional problems become more severe when psychotic experiences persist [47, 48]. A recent study by Yamasaki et al. [49] showed that symptoms of depression and anxiety worsened when psychotic experiences emerged, suggesting that identifying psychotic experiences may be key in early detection programs. Better methods to differentiate between adolescents with remitting problems and those with persistent problems at an early stage would provide opportunities for prevention and treatment.

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Compliance with ethical standards

Conflict of interest The authors have no conflicts of interest to declare.

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