Early risk indicators of internalizing problems in late childhood: a 9-year longitudinal study

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Background: Longitudinal studies on risk indicators of internalizing problems in childhood are in short supply, but could be valuable to identify target groups for prevention. **Methods:** Standardized assessments of 294 children's internalizing problems at the age of 2–3 years (parent report), 4–5 years (parent and teacher report) and 11 years (parent and teacher) were available in addition to risk indicators from the child, family and contextual domain. **Results:** Low socioeconomic status, family psychopathology at child age 2–3, parenting stress at child age 4–5 years, and parents' reports of child internalizing problems at age 4–5 years were the strongest predictors of internalizing problems at the age of 11. If these early risk factors were effectively ameliorated through preventive interventions, up to 57% of internalizing cases at age 11 years could be avoided. **Conclusions:** Predictors from as early as 2–5 years of age are relevant for identifying children at risk of internalizing problems in late childhood. The methodological approach used in this study can help to identify children who are most in need of preventive interventions and help to assess the potential health gain and efficiency of such interventions. **Keywords:** Internalizing disorder, risk factors, prevention. **Abbreviations:** AF: attributable fraction; IRR: incidence rate ratio; LEQ: Life Events Questionnaire; NNT: numbers needed to be treated; RD: risk difference.

Internalizing problems are intrapersonal problems such as depression, anxiety and fearfulness (Achenbach & Edelbrock, 1984) and they occur frequently. For instance, by the age of 16, approximately 15% of children have experienced an emotional disorder (Costello, Mustillo, Erkanli, Keeler, & Angold, 2003). Moreover, internalizing problems are known to persist even into adulthood (Newman et al., 1996; Pine, Cohen, Gurley, Brook, & Ma, 1998). Despite the high prevalence of internalizing symptoms in adolescence, the symptoms start well before adolescence (Najman et al., 2005; Luby et al., 2003; Lavigne et al., 1998) and are relative stable from early to late childhood (Mesman, Bongers, & Koot, 2001), into adolescence (Costello et al., 2003) and adulthood (Newman et al., 1996). Research has shown that internalizing problems are more frequently found among children from single parent families (Luoma et al., 1999) and among children from families with parental psychopathology (Downey & Coyne, 1990; Ormel et al., 2005). Internalizing problems in children are associated with parenting practices (Cummings, Davies, & Campbell, 2000), high parenting stress (Mesman & Koot, 2000b), low socioeconomic status (Wadsworth & Achenbach, 2005), and stressful life events (Cole, Nolen-Hoeksema, Girgus, & Paul, 2006; Nolen-Hoeksema, Girgus, & Seligman, 1992).

However, despite these findings, our knowledge about the development of internalizing problems in childhood, and the factors associated with their onset, is still limited. This is mainly due to the fact that only a few studies were directed at internalizing problems before or at the beginning adolescence, and most of these studies were of cross-sectional design, or had only short follow-up times. We therefore aim to 1) explore the longitudinal link between risk factors at age 2–5 years and the presence of high levels of internalizing problems at age 11 years, and 2) study how much of the incidence of internalizing problems at age 11 years could be reduced if effective prevention were targeted at these risk factors.

A few longitudinal studies investigated early childhood predictors of internalizing problems in late childhood or adolescence. For instance, the study by Leech, Larkby, Day, and Day (2006) started during the pregnancy of the mothers and followed their newborns until the age of 10 years. It was found that prenatal marijuana exposure, early environmental factors (e.g., household density) and child characteristics (child IQ, attention problems) predicted symptoms of anxiety and depression at the age of 10. Mesman and Koot (2000b) found that temperamental withdrawal and parental internalizing psychopathology were correlated with internalizing problems at the age of 11 for both boys and girls. In addition, they found that single parenthood at child age 2–3 years and stressful life events at age 4–5 were related to internalizing problems in girls and poor school results were related to internalizing problems in boys. Similarly, in adolescents, Leve, Kim, and Pears (2005) reported that fear/shyness

and maternal depression at the age of 5 were predictive of internalizing problems at the age of 17.

Thus, there is some data on the longitudinal link between being exposed to risk variables and the development of internalizing problems in children and adolescents. However, all of these previous studies focused on the strength of the association between the risk factor and the outcome. Although this provides valuable knowledge, from a prevention perspective additional information is needed. It is, for example, important to know the number of children exposed to a certain risk factor (or set of risk factors) in order to assess whether or not it is logistically feasible and economically affordable to offer them preventive interventions. In addition, we need to understand the potential health gain when the adverse effects of a particular risk factor could be fully contained by an intervention.

Thus, to summarize, the aim of the current study is to identify risk indicators at age 2–3 and 4–5 years that are predictive of internalizing problems at the age of 11 years. We then aim to facilitate the development of preventive interventions by identifying the most relevant risk indicators, assessing how many children would need to be targeted by preventive interventions and how large the potential health gain would be. This approach, introduced in the area of late-life depression (Smit, Beekman, Cuijpers, de Graaf, & Vollebergh, 2004; Smit, Ederveen, Cuijpers, Deeg, & Beekman, 2006), seeks to identify high-risk groups where preventive interventions are most likely to generate the largest health gains for the least effort. This may help to design cost-effective preventive interventions for internalizing problems in children.

Methods

Participants, design and procedure

Our study is a secondary analysis of longitudinal data on the development of children from the general population. The original study is described in detail elsewhere (Mesman & Koot, 2000a; Koot, van den Oord, Verhulst, & Boomsma, 1997). In 1989 (T1), a random age and sex stratified sample of children aged 2–3 years was drawn from the inoculation register of the Dutch province of South Holland and from the Rotterdam municipal population register. This resulted in a sample of 420 children (mean age = 2.6 yrs; response 91%), whose parents participated in the study by answering a postal questionnaire and completing a home interview. In 1991 (T2), all parents were approached for participation in a follow-up study. After receiving a letter informing them about the study, the parents were contacted by telephone to obtain consent and then sent questionnaires. The parents also provided consent for the teacher report and the child report. Information was obtained for 397 of the 420 children participating at T1 (mean age = 5.3 yrs; response 95%). In 1997 (T3), parents of all children who participated at T1 were approached for participation in a second follow-up.

Information was obtained for 358 children (mean age = 10.9 yrs, 85% of T1 participants) in addition to 294 teacher reports.

For the present study, children with a parent or teacher rating on internalizing problems were included ($N = 358$). No significant differences were found between this sample and the original T1 sample ($N = 420$), regarding sex (χ^2 (1, $N = 420$) = .12, $p > .05$), T1 socioeconomic status (F = 3.12, $p > .05$) and T1 CBCL Internalizing Problems score ($t = 1.34$, $p > .05$). Of the 358 children, 182 were boys (50.8%) and 176 were girls (49.2%). The average age of the children at T3 was 10 years 11 months (mean = 10.93, SD = .60). The study was approved by the medical ethics committee of the Erasmus University Teaching Hospital.

Measures

Outcome variable. The validated Dutch versions of the Child Behavior Checklist (CBCL; Achenbach, 1991a; Verhulst, van der Ende, & Koot, 1996) and Teacher's Report Form (TRF/4-18; Achenbach, 1991b; Verhulst, van der Ende, & Koot, 1997) were used. At T3, the parents completed 120 items of the CBCL/4–18 and teachers filled in the TRF/4–18. The items were rated on a 3-point scale ranging from 0 ('not applicable at all') to 2 ('very much or often applicable'). The Internalizing scales of both instruments were used. The Dutch versions of the CBCL and TRF show good reliability and discriminative validity (Verhulst, Akkerhuis, & Althaus, 1985a; Verhulst, Berden, & Sanders-Woudstra, 1985b; Verhulst & Akkerhuis, 1986).

Putative risk indicators

Parent and teacher rated internalizing and externalizing problems. At T1, parents filled in the 100-item CBCL/2–3 (Koot et al., 1997; Achenbach, 1992). At T2, the parents filled in the CBCL/4–18 and teachers filled in the TRF/4–18. The Internalizing and Externalizing scale scores were dichotomized using the Dutch borderline cutoff scores (Koot et al., 1997; Verhulst et al., 1996, 1997).

Child health was assessed with help of a single question: 'How would you rate the health of your child in general?' At T1, the parents answered on a 5-point scale, ranging from 'excellent' to 'poor'. At T2, the parents answered on a 4-point scale, ranging from 'excellent' to 'poor'. The variable was dichotomized into the categories 'good or excellent' and 'poor'.

Single parenthood status was determined during the parent interview at T1.

Life events were assessed by the Life Events Questionnaire (LEQ; Berden, Althaus, & Verhulst, 1990). The questionnaire consists of 32 items assessing potentially stressful life situations, e.g., parent leaving the family. At T1, the parents filled in whether the event had occurred in their child's life. At T2, the parents indicated whether or not an event had occurred in their child's life during the last 12 months. The variable was dichotomized into the categories 'no life event' and '1 or more life events'. The test–retest reliability of the Dutch LEQ for the total event score was reported to be .90 and inter-parent agreement was found to be .78 (Berden et al., 1990).

Parenting stress at T1 was assessed through the mother reporting being tired from upbringing most of the time (on a 4-point scale ranging from 'never' to 'most of the time').

Parenting stress at T2 was assessed by the Parenting Stress Index (PSI; Abidin, 1983). The Dutch version of the questionnaire was used to assess the level of perceived parental stress (De Brock, Vermulst, & Gerris, 1990). The items were scored on a 6-point Likert scale. High levels of parenting stress were based on a score higher than one standard deviation above the mean.

Negative maternal attitude was calculated at T1 as a combination of two interview items: 'mother irritated by child' (6-point Likert scale ranging from 'never' to 'every day') and 'mother wanting to hurt the child' (4-point Likert scale ranging from 'never' to 'often'). Negative maternal attitude represented mother reporting being irritated by her child several times per week or more often and wanting to hurt the child sometimes or often.

Family psychopathology at T1 and T2 was assessed in an interview with the parent. At T1, the variable 'family psychopathology' represented poor maternal or paternal mental health. At T2, the variable 'family psychopathology' represented the use of mental health services by a member of the nuclear family.

Socioeconomic status was obtained from the parent reports at T1. Low SES, characterized as being unemployed or having a primary-level job (Statistics Netherlands, 1993), was defined as a risk indicator.

Statistical analyses

To obtain a robust measure of internalizing problems at age 11 years, a latent variable of internalizing problems was created. The parent and teacher ratings of internalizing problems at T3 served as indicators. The latent factor scores were used to identify high versus low internalizing cases, based on a score at or above the 84th percentile of the distribution. The latent factor scores were controlled for (male) sex as the borderline cut-off of the CBCL/TRF is sex specific. The latent factor scores were obtained using Mplus 4.21 (Muthén & Muthén, 1998–2007).

Using the high versus low internalizing cases as the dependent variable, the remaining analyses were carried out in three steps, using Stata (StataCorp, 2004). First, simple regression models were conducted to describe the bivariate association between risk indicators and internalizing problems at age 11 years. In the second step, all risk indicators were entered simultaneously in the regression equation. This produced the so-called 'complete multivariate model'. In the third step only statistically significant risk indicators were retained after a backward-stepping regression model was employed. This gave rise to the so called 'parsimonious multivariate model'. The risk difference (RD) was obtained from the above regression models, the numbers needed to be treated (NNT) were obtained as the inverse of the RD, and incidence rate ratio (IRR) was obtained under a Poisson regression model. Under the latter model we also obtained the population attributable fraction (AF) using Stata's downloadable aflogit procedure. The interpretation of these statistics is as follows. The RD index is the difference in the risk of developing internalizing problems between exposed and unexposed children. The NNT indicates how many children would have to receive a preventive intervention to avoid one new case with internalizing problems, assuming that the adverse effect of the risk factor can be completely blocked by some preventive intervention. The NNT is thus an indicator of the maximum efficiency of the intervention. The IRR is the ratio of the incidence rate of internalizing problems in a group of exposed children over the incidence rate in the unexposed group. The IRR thus captures the strength of association between an exposure and outcome, not unlike a relative risk or an odds ratio. Finally, the AF reflects the percentage by which the incidence rate of internalizing problems can be reduced when the adverse effect of a risk factor is eliminated by a preventive intervention. Higher RDs, IRRs and AFs, and lower NNTs point to greater utility of the studied risk indicators for preventive interventions, because then we may expect that substantial health gains can be generated in an efficient way.

In the final step, the possibly cumulative effect of the risk indicators of the significant predictors was investigated. This was done by calculating a risk index, which represents the sum of the present risk indicators (obtained from the parsimonious multivariate model). The impact of the cumulative risk indicator on outcome was investigated using Kendall's tau.

Results

Sample characteristics

The sample included in this study consisted of 358 children. Data was complete for 294 children, and final models of the analyses were based on this sample. Children with missing data did not differ from children with complete data with respect to sex, χ^2 (1, $N = 358$) = 1.19, $p > .05$, with respect to low SES, χ^2 (1, $N = 358$) = 1.19, $p > .05$, or in their probability of being classified as high internalizing at T3, χ^2 (1, $N = 358$) = .37, $p > .05$. Table 1 gives an overview of the percentage of children exposed to each of the risk indicators, and the significant predictors from the simple regression models (step 1 analyses).

Risk indicators of internalizing problems: multiple regression model

All risk indicators from the complete multivariate regression model were entered into a backward-stepping regression model to obtain a smaller set of statistically significant predictors. Four risk indicators were retained in the parsimonious model: low socioeconomic status, T1 family psychology, T2 parenting stress, and T2 internalizing problems as reported by the parents.

Importance of the selected risk indicators for preventing internalizing problems

Table 2 presents the RDs, NNTs, IRRs, and AFs of the parsimonious model. It shows that the four risk indicators together resulted in a total AF of 57%,

Table 1 Percentages of children exposed to risk indicators and simple regression association between risk indicators and internalizing problems at age 11

Risk indicators	Total N = 358	Children with INT problems N = 58	RD	95% CI	NNT	IRR	95% CI	AF (%)	95% CI
	%	%							
Risk indicators from age 2–3 years									
Low socioeconomic status	26.5	44.8	.15	.07–.24***	6.7	2.30	1.37–3.88**	25.8	10.3–38.7
Single parenthood	6.1	6.9	.02	−.14–.18	50.0	1.12	.40–3.09	.7	−5.1–6.3
Family psychopathology	9.5	19.0	.18	.05–.31**	5.6	2.20	1.14–4.23*	10.3	2.0–18.0
Negative life events (lifetime)	45.3	53.4	.05	−.03–.13	20.0	1.36	.81–2.28	14.1	−8.1–31.8
High parenting stress	7.5	13.8	.14	−.00–.29	7.1	1.93	.92–4.07	6.7	−.6–13.4
Poor child health	8.5	22.4	.29	.16–.43***	3.4	3.12	1.68–5.78***	15.2	7.3–22.5
Negative maternal attitude	12.6	15.5	.04	−.07–.16	25.0	1.26	.62–2.56	3.2	−5.8–11.4
EXT problems	17.3	36.2	.21	.11–.31***	4.8	2.71	1.59–4.63***	22.8	5.7–33.2
INT problems	17.0	29.3	.14	.04–.24**	7.1	2.02	1.14–3.55*	14.8	3.3–24.9
Risk indicators from age 4–5 years									
Family psychopathology	7.8	17.2	.21	.07–.35**	4.8	2.48	1.25–4.92**	10.7	2.9–17.9
Negative life events (past 12 months)	53.9	67.2	.09	.01–.17*	11.1	1.82	1.02–3.25*	31.9	2.8–52.3
High parenting stress	12.3	32.8	.31	.20–.43***	3.2	3.61	2.04–6.39***	27.4	15.5–37.7
Poor child health	16.2	31.0	.18	.08–.28**	5.6	2.37	1.35–4.15**	18.6	6.8–28.9
EXT problems – parent report	23.2	39.7	.19	.10–.28***	5.3	2.81	1.61–4.91***	30.4	14.2–43.6
INT problems – parent report	21.2	51.8	.28	.19–.37***	3.6	3.83	2.27–6.47***	38.3	23.8–50.0
EXT problems – teacher report	18.4	24.1	.06	−.04–.16	16.7	1.42	.77–2.65	8.5	−5.5–20.7
INT – teacher report	15.1	24.1	.12	.01–.23*	8.3	1.83	.98–3.40	13.0	.1–24.1

Note. EXT = externalizing, INT = internalizing, RD = risk difference, CI = confidence interval, NNT = numbers needed to be treated, IRR = incidence rate ratio, AF = attributable fraction, *p < .05, **p < .01, ***p < .001.

Table 2 Predictors of internalizing from stepwise regression model (N = 294)

Parsimonious model	RD	95% CI	NNT	IRR	95% CI	AF (%)	95% CI
T1 Low socioeconomic status	.10	.01–01.19*	9.8	1.66	.93–2.96	17.0	3.5–28.6
T1 Family psychopathology	.15	.02–.28*	6.7	1.81	.91–3.61	10.1	3.4–16.3
T2 Parenting stress	.21	.10–.32***	4.8	2.10	1.12–3.95*	20.3	8.6–30.5
T2 Internalizing problems – parent report	.23	.14–.33***	4.3	2.90	1.59–5.29	34.8	18.7–47.7
Total AF						57.0	

Note. RD = risk difference, CI = confidence interval, NNT = numbers needed to be treated, IRR = incidence rate ratio, AF = attributable fraction, *p < .05, **p < .01, ***p < .001.

implying that with this set of risk indicators, 57% of the future cases of internalizing problems can be identified. We use the third row in Table 2, corresponding to parenting stress, as an illustration. The RD suggests a large difference in the likelihood of having internalizing problems (21% difference) at the age of 11 between children whose parents report stress due to daily parenting when their child was 4–5 years, compared to parents who reported no stress. The low NNT suggests that 4.8, say, 5 families would have to receive an intervention blocking the adverse effect of parenting stress, in order to avoid one child with internalizing problems (assuming that the intervention is completely successful in containing the adverse effect of parenting stress). The IRR, which can be interpreted as an odds ratio, shows the increase in the probability of internalizing problems among children whose parents report high parenting stress relative to the unexposed group. The AF indicates that of all children with internalizing problems at

the age of 11, 20.3% can be attributed to parenting stress at child age of 4–5 years. In other words, when all parents that reported parenting stress when their child was 4–5 years had received a completely successful intervention to cope with their stress, the prevalence of their children's internalizing problems at the age of 11 would have been reduced by 20%.

Cumulative effect

We also studied whether the probability of having internalizing problems at age 11 years was increased in the presence of exposure to multiple risks. Under the parsimonious model, a child could have 0–4 risks simultaneously. However, as very few children had 3 or 4 indicators present (5.1%), the categories 'no risk indicator', '1 risk indicator', and '2 or more risk indicators' were created. It was then demonstrated that the probability of internalizing problems rose sharply with the number of joint exposures;

from 6.4% when having 0 exposures, 15.5% when having an exposure to only one risk indicator, to 48.0% when being exposed to two or more risk indicators. Accumulative exposures were significantly related to an increase in the risk for internalizing problems (Kendall's tau = .33, $p < .001$).

Discussion

This study investigated how risk indicators when children were aged 2–5 may help to identify internalizing problems at age 11, and thus tried to identify high-risk groups where prevention should play an important role. As expected, internalizing problems of the child at the age of 4–5 (as reported by their parents) predicted persistence of such problems to age 11 years. This finding supports those of Lavigne et al. (1998), who followed children aged 2 to 5 years over a 2-year period and found a considerable stability of emotional disorder among these children. Similar results were found for older children, suggesting a high continuity of internalizing problems (Costello et al., 2003; Mathijssen, Koot, & Verhulst, 1999). However, above and beyond this continuity, low socioeconomic status, family psychopathology at child's age 2–3, and parenting stress at the child's age of 4–5 predicted internalizing problems at age 11 years. The identification of these additional risk factors is also in accordance with previous findings. For instance, low socioeconomic status was also related to internalizing problems in another study (Wadsworth & Achenbach, 2005). With respect to parental psychopathology, Ormel et al. (2005) found that parental lifetime psychopathology predicted adolescents' internalizing problems. Similarly, Mesman and Koot (2000b) reported parental internalizing psychopathology to be related to internalizing psychopathology in preadolescents. Both maternal (Leve et al., 2005) and paternal psychopathology (Kane & Garber, 2004; Compas, Phares, Banez, & Howell, 1991) were found to be related to offspring internalizing problems. Finally, parenting stress has previously been associated with child behavior and emotional problems (Crnic, Gaze, & Hoffman, 2005). In a study by Mesman and Koot (2000b), parenting stress was found to be a generic predictor of both child internalizing and externalizing psychopathology. In a study of adjustment problems in preschoolers, parenting stress was found to be related more strongly to internalizing than externalizing problems (Anthony et al., 2005).

In addition to studying risk indicators for internalizing problems, we also studied the amount of health gain if prevention succeeded in eliminating the adverse effect of the selected risk indicators. Until now, this approach has hardly been used in the study of childhood internalizing problems. Our results showed that the three variables jointly reached an attributive fraction of 57%, implying that when these risk indicators were targeted by a completely effective intervention, the incidence of internalizing problems would decrease by as much as 57%. This percentage is remarkable when considering that the long time-interval between predictors and outcome was considerable (6–9 years), and the fact that the follow-up period covered a large number of transitions (e.g., to formal education) and numerous developmental changes. This long period of time also gives a wide window of opportunity to identify these children and offer them and their parents an intervention.

In a meta-analysis of studies on prevention of the incidence of mental disorders in adults, it was found that the incidence can be reduced by about 30% (Cuijpers, van Straten, & Smit, 2005). Given this number and our identified AF of 57%, and assuming that the risk indicators would be effectively targeted, in theory the reduction in internalizing problems could be about 17%. However, two of our identified risk indicators, maternal psychopathology and early childhood internalizing problems, might be influenced by genetic factors and therefore more difficult to target. This may imply that our estimated health gain is too optimistic. Still, significant health gain could be achieved. For instance, maternal psychopathology may result in high perceived parenting stress. With an AF of 20.3% for parenting stress, teaching parents how to cope effectively with daily parenting stress would lead to a reduction in internalizing problems at age 11 years of about 6%, regardless of the possible genetic risk. As, in addition to genetic influences, the expression of maternal psychopathology and early childhood internalizing problems is also environmentally mediated, health gain is likely to be higher when all risk variables are targeted.

It is also important to note, though, that one of the four predictors of internalizing problems at the age of 11 identified in this study was internalizing problems at the age of 4–5 as reported by parents. Therefore, when we speak of prevention, what we have in mind is a broader concept including secondary prevention, that is, efforts directed at limiting adverse consequences of a condition that is already present.

In this study, a cumulative risk index was constructed, which was also a predictor of internalizing problems at the age of 11. This is in line with a few other studies which found a dose–response relationship between the number of risk factors and internalizing problems. For example, Gerard and Buehler (2004) found an association between cumulative risk and internalizing problems in a large sample of adolescents. Similar results were reported by other studies (e.g., Loukas & Prelow, 2004; Dekovic, 1999). However, even if there was an indication of a dose–response relationship, it is possible that not only the sum or accumulation of risk indicators is important, but that there are specific combinations of risk indices that predispose children to elevated risk of internalizing problems.

This intriguing question should be answered by future studies with larger samples, which would allow for analyses with groups of children with specific combinations of risk indicators.

One of the limitations of the study is the relatively small sample size. This led, for instance, to small numbers of children in each category in the analyses of cumulative effects. These results are therefore of an informative character only, and need to be interpreted carefully. Also, a larger sample could have allowed for separate analyses for boys and girls, which might have resulted in sex-specific findings. It is important to note that the reported levels of attributable fraction overestimate real health gain, because it is unrealistic to expect that a preventive intervention would be completely successful in eliminating a risk factor or completely containing its adverse effect. The results thus represent upper limits of the possible health gain and need to be treated with caution.

Conclusion

This paper showed that over a follow-up of 6–9 years, a number of potentially malleable risk factors account for a significant proportion of children with high levels of internalizing problems at age 11 years. Besides examining the association between a risk factor and internalizing problems, we demonstrated the potential these risk factors have for preventive interventions, in terms of possible health gain (the population attributable fraction), and the likely efficiency of the preventive intervention (the numbers needed to be treated). The results of this study suggest that more attention should be given to children from families with low socioeconomic status and to children whose parents experience high levels of parenting stress. At the same time, clinicians should be vigilant about internalizing symptoms at preschool age, because these might be persistent and predictive of later internalizing problems. Moreover, our results showed that when prevention is effectively directed at the early identification and alleviation of these risk factors, a large proportion of internalizing psychopathology in later life can be prevented.

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