

Learning Processes Associated with Panic-Related Symptoms in Families with and Without Panic Disordered Mothers

Jiske E. G. de Albuquerque · Simone Munsch ·
Jürgen Margraf · Silvia Schneider

© Springer Science+Business Media New York 2012

Abstract The present study compared learning processes associated with panic-related symptoms in families with and without panic disordered mothers. Using a multi-informant approach, 86 mothers [of whom 58 had a primary diagnosis of panic disorder (PD)], their partners and teenage children (mean age, 16.67 years) reported about parents' behavior (modeling and operant learning) in response to children's and parents' experience of panic-related symptoms. Both, maternal and child reports revealed that mothers with PD were more likely to show panic-maintaining behavior and to involve their children in their own experience of panic-related symptoms than mothers without PD. Mothers with PD reported more often to be punished by others for their experience of panic-related symptoms than mothers without PD. Conversely, parent and child reports did not reveal differences between parents' reactions to their children's experience of panic-related symptoms in families with and without a PD mother. Given that mothers with PD were reported to

behave differently in relation to their own experience of panic-related symptoms but not in relation to their children's experience of panic-related symptoms, the present study offers preliminary evidence that modeling, rather than operant learning, might affect children's sensitivity to somatic symptoms.

Keywords Panic disorder · Learning experiences · Operant learning · Modeling · Childhood anxiety

Introduction

Several lines of evidence suggest that the development of panic disorder (PD) is a function of an interaction between biological and psychological vulnerabilities [1–3]. A modern learning theory perspective on the etiology of PD [3] explicitly distinguishes between two sets of psychological vulnerabilities: nonspecific and specific. Nonspecific psychological factors refer to prior experience with uncontrollable and unpredictable aversive events, leading to a diminished sense of control in children, for example when children are not allowed to discover the world and acquire new competencies due to overcontrolling parents [4]. Specific psychological factors concern early learning experiences involving an anxious model, such as observing parents coping and reacting to possible dangerous bodily sensations [3]. Years before Bouton et al.'s [3] publication, Rachman [5] already hypothesized three main learning pathways in the acquisition of fears: First a direct pathway, whereby fear is acquired through classical conditioning, and two further indirect processes, where fears are learned through “vicarious learning” and “transmission of information/verbal instruction”. More recently, another indirect pathway to fear has been suggested in which parents may

J. E. G. de Albuquerque · S. Munsch · J. Margraf · S. Schneider
Department of Psychology, University of Basel,
Missionsstrasse 60/62, 4003 Basel, Switzerland

J. E. G. de Albuquerque · S. Munsch
Institute of Psychology, University of Lausanne,
Dorigny, 1015 Lausanne, Switzerland

J. Margraf · S. Schneider
Department of Psychology, Ruhr University of Bochum,
44780 Bochum, Germany

S. Schneider (✉)
Faculty of Psychology, Clinical Child and Adolescent
Psychology, Ruhr University of Bochum,
Universitätsstrasse 150, 44789 Bochum, Germany
e-mail: silvia.schneider@rub.de

reinforce anxious/avoidant behavior in their children [6, 7]. According to Field, Ball, Kawycz, and Moore [8], children filter their parents' cognitions and behaviors through such pathways to fear.

Taken together, in addition to direct conditioning, parents may provide their children with anxiety-related learning experiences through three indirect learning mechanisms: (a) reinforcement of anxious/avoidant behavior (operant learning), (b) modeling (vicarious learning), and (c) information transfer (instructional learning) [9]. A study by Ehlers [10] investigated such indirect learning experiences in patients with PD, patients with less frequent panic symptoms, patients with other anxiety disorders and in normal controls. Ehlers' retrospective results [10] revealed that when compared to patients without panic symptoms, patients with panic symptoms reported receiving more encouragement for sick-role behavior/panic symptoms from their parents when experiencing panic symptoms. Moreover, compared to the control group, patients with panic symptoms reported having more often observed sick-role behavior related to panic symptoms in their parents. In this context, sick-role behavior can be defined as any activity undertaken to minimize the effects of panic symptoms and to relieve stress coupled with these symptoms, such as talking about the symptoms with others, avoiding doing certain things that may provoke a panic attack or seeking for medical attention. As the "encouragement of sick-role behavior/panic symptoms" scale used by Ehlers [10] encompassed reinforcement and punishment for sick-role behavior related to panic symptoms as well as verbal transmission of the idea that anxiety symptoms are dangerous, the study indicated that operant, instructional and vicarious learning (modeling) may play a role in the etiology of panic disorder. However, given that operant and instructional learning experiences were assessed according to a global scale called encouragement, no consistent conclusions can be drawn about the unique contribution of each learning experience alone. Moreover, despite the fact that recent empirical research has examined instructional learning experiences in specific and social phobia, concluding that previously obtained negative information about a stimuli may alter children's cognitive thoughts and increase their fear levels when the stimuli is encountered again [11–14], research considering the potential role of these particular learning processes for the development of PD is still scarce [15]. Another line of research has focused on the relationship between learning experiences and anxiety sensitivity and indicated that learning experiences during childhood and adolescence may play a role in the development of anxiety sensitivity. In particular, Watt, Stewart, and Cox [16] found that subjects with higher levels of anxiety sensitivity reported more operant, vicarious, and instructional learning experiences than subjects with lower

levels of anxiety sensitivity. In the same way, a study conducted by Muris et al. [17] found a link between instructional learning experiences and anxiety sensitivity in a sample of normal adolescents. However, no such relation was found between parental reinforcement or observation of somatic symptoms and adolescents' levels of anxiety sensitivity. The rationale behind these findings is that learning experiences associated with somatic symptoms in general may contribute to higher levels of anxiety sensitivity and lead to an increased risk of developing an anxiety disorder [17].

Based on the findings of Ehlers [10] in particular, the present study was intended to investigate the relation between maternal PD and indirect learning mechanisms associated with panic-related symptoms. The principal aim of this study was to compare the way parents of families with and without a panic disordered mother deal with their own panic-related symptoms as well as how they react to the panic-related symptoms of their children. A questionnaire was used to assess the reaction of parents to panic-related symptoms of mothers, fathers and children and the involvement of children in their parents' behavior. Nevertheless, the relatively low internal consistency estimates of some subscales should be acknowledged when interpreting the present results, in that they may not have fully tapped the intended constructs. Considering the shortcomings associated with the study of Ehlers [10] based on retrospective reports of adult patients with panic disorder, the present study included three separate informants; children, mothers and fathers. To avoid recollection bias and to prevent positive perception of previous negative experiences, we included current reports of a high-risk group for panic disorder, namely children of mothers with panic disorder. To control for panic status, parents and children were asked to report the frequency with which they experienced panic-related symptoms and how parents handled these symptoms. To begin with, we analyzed whether the groups of parents (with vs. without a PD mother) reacted differently to their children's experience of panic-related symptoms. Based on the results of Ehlers [10] we hypothesized that mothers as well as children would perceive mothers with PD to reinforce their children's experience of panic-related symptoms more often and to be more supportive than non-PD mothers. Furthermore, we expected mothers and children to report less punishment and less negative verbal instructions in relation to children's experience of panic-related symptoms in families where the mother suffered from PD compared to families where the mother did not suffer from PD. In a second step, we assessed whether the groups of parents reacted differently to their own experience of panic-related symptoms and whether they involved their children differently in their own experience of panic-related symptoms. We

hypothesized that children and mothers would perceive mothers with PD to receive more positive reinforcement in relation to their panic-related symptoms, to show more panic-maintaining behavior when exposed to their panic-related symptoms and to involve their children more in their own panic-related symptoms than mothers without PD. No hypothesis were formulated for the partners of mothers with PD, these variables were treated as exploratory.

Method

Participants

The sample is composed of families participating in wave two of a prospective longitudinal high-risk study on PD. Eighty-six mothers, their partners (referring to the fathers of the children), and children participated in the study. The original sample encompassed 110 children but because some families had more than one child, only the youngest child of each family was included, to assure independence of the data. Parents were initially recruited from two sources; from outpatient clinics for adults with PD (with or without agoraphobia) and by newspaper advertisement in order to recruit parents and children without a history of a mental disorder. At wave two, children were between 10 and 22 years of age ($M = 16.67$, $SD = 2.58$).

In the present study, 58 mothers were diagnosed as suffering from current or lifetime PD (“mothers with PD”) and 28 mothers showed no history of mental disorders (“mothers without PD”). The sociodemographic and clinical characteristics of mothers and children are presented in Table 1. No significant differences were found between mothers with and without PD regarding their age, family status and education. However, comorbidity was 41.4 % for the mothers with PD and inexistent for the mothers without PD. The group of children having a mother with PD were found to be significantly younger than the children of the control group, $F(1,82) = 6.88$, $p < 0.01$. They also had more current anxiety disorders than the children of diagnosis-free mothers. Our original idea was to include fathers and mothers with PD, however since only one father had a current or lifetime diagnosis of PD, we only took into account the panic status of the mother and excluded the one family in which the father suffered from PD.

Measures

Diagnostic Assessment

A structured interview was used to assess the presence of mental disorders according to DSM-IV [18] in all

Table 1 Sociodemographic and clinical characteristics of mothers and children. Means (standard deviations) or absolute (relative) frequencies

	Mothers with PD ($N = 58$)	Mothers without PD ($N = 28$)
<i>Maternal characteristics</i>		
Age (years)	42.73 (5.06)	44.57 (5.56)
Number of children per family	2.12 (0.95)	2.21 (1.37)
Family status		
Married living together	46 (80.7 %)	23 (82.1 %)
Unmarried	2 (3.5 %)	1 (3.6 %)
Divorced-living apart	9 (15.8 %)	4 (14.3 %)
Education		
General education	11 (19.3 %)	6 (23.1 %)
Secondary school	28 (49.1 %)	6 (23.1 %)
Gymnasium/university	18 (31.6 %)	14 (53.8 %)
Current comorbidity	23 (41.4 %)*	–
<i>Child characteristics</i>		
Age (years)	16.16 (2.62)	17.68 (2.20)
Sex of child (female)	35 (60.3 %)	16 (57.1 %)
Current primary diagnosis		
Panic disorder	4 (6.9 %)	–
Social phobia	6 (10.3 %)	3 (10.7 %)
Specific phobia	6 (10.3 %)	2 (7.1 %)
OCD	1 (1.7 %)	–
Dysthymic disorder	1 (1.7 %)	–
Drug dependence/Abuse	–	1 (3.6 %)
Developmental disorder	1 (1.7 %)	–

PD panic disorder

* Specific phobia, Social phobia, Generalised anxiety disorder, Obsessive compulsive disorder (OCD), Dysthymic disorder, Depression, Hypochondria, Somatization disorder

participants. Parents’ diagnostic status was assessed according to the Mini-DIPS [19] and children’s diagnostic status was assessed according to the F-DIPS [20] by relying on children’s own evaluations. Both the Mini-DIPS and F-DIPS are modified versions of the “Diagnostisches Interview bei Psychischen Störungen” (Diagnostic Interview for mental disorders) (DIPS; [21]), a German translation of the Anxiety Disorders Interview Schedule (ADIS; [22]) for DSM-IV. The reliability and validity of the F-DIPS were tested in a sample of 191 patients from a psychosomatic clinic [23]. The retest-reliabilities (range retest interval = 1–4 weeks) for current diagnoses were good, ranging between 0.64 and 0.89 (k -coefficient) and 0.65 and 0.94 (Yule’s Y -coefficient). In the same study, the validity of the F-DIPS was examined by using self-report questionnaires and diagnoses made by therapists. Overall the F-DIPS proved to be a valid instrument for the assessment of mental disorders [23]. To test the reliability

of the Mini-DIPS, 100 individuals were examined with the DIPS and Mini-DIPS by two independent clinical psychologists. The inter-rater reliability ranged between 0.84 and 1.0 (k -coefficient) and 0.75–1.0 (Yule Y -coefficient) [19]. In the present study, interviewers were psychologists or graduate psychology students and received an extensive 1-week training in the use of the standard diagnostic interview. In order to check the accuracy of the diagnoses, all interviews were tape-recorded and reassessed by doctoral degree supervisors. In the present work, inter-rater reliability for current diagnosis of anxiety disorder ranged between 0.85 and 1.0 (k -coefficient). Unclear cases were discussed until a consensus was reached.

Learning Processes Associated with Panic-Related Symptoms

A modified version of the Parent–Child Questionnaire (PCQ [24]) was used to assess learning processes associated with panic-related symptoms. The PCQ is mainly intended to gather information on parental modeling, operant and instructional learning associated with panic-related symptoms and the involvement of children in parental panic-related behavior. It consists of 12 items, each rated on a 4-point Likert scale (never, sometimes, often, and always) by mothers, fathers and children. The questionnaire is divided into two parts: (1) the frequency of panic-related symptoms in children and the way parents react to them (PCQ-C); (2) the frequency of panic-related symptoms in parents, the way they cope with them and the involvement of children in this behavior respectively the symptomatic of their parents (PCQ-P). In other words, children report about the behavior of their parents whenever they themselves experience panic-related symptoms. Secondly they report about their parents' behavior whenever they observe their mothers experiencing panic-related symptoms and finally whenever their fathers experience these symptoms. On the other hand, parents report about their reaction to the panic-related symptoms of their children and their behavior with respect to their own panic-related symptoms. In line with Rachman's theory [7], PCQ-C corresponds to operant learning (parental reinforcement or punishment of children's panic-related symptoms) and instructional learning experiences (parental instructions on how to handle or interpret panic-related symptoms) and PCQ-P to observational learning experiences (children observing their parents' behavior with respect to their own panic-related symptoms).

PCQ-C (Operant and Instructional Learning) PCQ-C measures learning experiences associated with how parents react to their children's panic-related symptoms. In this

sense, the first three items investigate operant learning experiences. The “*Reinforcement*” item assesses to what extent children's experiences of panic-related symptoms are ‘reinforced’ by their parents (“when I experience these bodily sensations, my mother understands my irritability and sensitivity”). The “*Punishment*” item measures negative and punitive reactions of the parent (“when I experience these bodily sensations, my mother won't take me seriously”). The “*Support*” item measures to what extent parents help children cope with their panic-related symptoms (“when I experience these bodily sensations I ask my mother to help me with my homework or things I have to finish”). The three last items assess “*Verbal Instruction*”, measuring parental instructions that suggest a threatening nature of the panic-related symptoms and thus may maintain panic-related symptoms (e.g., “when I experience these bodily sensations, my mother recommends me to see a doctor or to take a medicine”).

PCQ-P (Vicarious Learning) PCQ-P distinguishes three types of parental behaviors that the child can observe in relation to parental panic-related symptoms: The “*Reinforcement*” item assesses to what extent parental experiences of panic-related symptoms are ‘positively reinforced’ by the family members (“when my mother experiences these bodily sensations, my family understands her irritability and sensitivity”). The “*Punishment*” item measures negative and punitive reactions of others (“when my mother experience these bodily sensations, others don't take her seriously”). The three “*Panic-Maintaining Behavior*” items measure to what extent parents show avoidant behavior when exposed to panic-related symptoms (e.g., “when my mother experiences these bodily sensations, she sees a doctor or takes medicine”). A last item, referred to as ‘*Involvement*’, was included to investigate how strongly children were involved in the panic-related behavior of the parent (“when my mother experiences these bodily sensations, she asks me to help her with domestic chores or other things”).

The psychometric properties of the original 56-item parent–child questionnaire were examined in a sample of 104 families [24]. Internal consistencies ranged between 0.36 and 0.85 for PCQ-C and between 0.58 and 0.87 for PCQ-P. Apart from the punishment scale in PCQ-C (with an internal consistency coefficient of 0.36), all scales showed acceptable to good internal reliability. Retest reliability coefficients were found to be satisfactory, between 0.60 and 0.87 for the “child” part and between 0.50 and 0.75 for the “parent” part. The low reliability coefficients of the PCQ are likely due to the relatively small number of items to measure a specific construct and the fact that items differed in meaning, although they were measuring the same underlying construct.

Statistical Analysis

To begin with, we used χ^2 tests to analyze whether the frequency of symptoms (“never, nearly never”—“sometimes”—“always”) in mothers, their children and partners differed between the panic group and the control group. In a second phase, we ran separate multiple analyses of variance (MANOVAs) to investigate whether the groups of parents (with vs. without a PD mother) reacted differently to their children’s and own experience of panic-related symptoms; and whether they involved their children differently in their own experience of panic-related symptoms. The statistical tests were performed with ranked data, since raw data would violate the assumption of multivariate homogeneity of variance [25]. Mann–Whitney U tests were chosen for post hoc comparisons of individual dependent variables, in view of the non-normal score distributions. Given that subjects’ observations were not independent, in that more than one child from some families took part in the study, we included only the youngest sibling of each family in data analysis. Compared to the original sample ($N = 110$), the sample used in this study consisted of 86 offspring, their mothers and fathers. All the analyses were performed on this sample.

Results

Frequency of Panic-Related Symptoms in Children, Mothers and Fathers

The reports of children, mothers, and fathers, using the parent–child questionnaire (PCQ), indicated no differences between the frequency of panic-related symptoms in children with versus without a PD mother. On average, 56 % of the children with a PD mother reported panic-related symptoms sometimes, often or very often, compared to 43 % of the children without a PD mother. Similarly, the reports of children and fathers revealed no differences between the frequency of panic-related symptoms in fathers having a partner with versus without PD. On average, 50 % of the fathers having a PD partner experienced some kind of panic-related symptoms, against 30 % of the fathers with a partner without PD. Contrary to the frequency of panic-related symptoms in children and fathers, a significant difference in symptom frequency was found between mothers with versus without PD. The reports of children and mothers revealed that mothers with PD had significantly more panic-related symptoms than diagnosis-free mothers, Mantel-Haenszel $\chi^2(2) = 31.96$, $p < 0.00$ (mothers’ view) and Mantel-Haenszel $\chi^2(2) = 18.19$, $p < 0.00$ (children’s view). On average, 94 % of the mothers with PD reported experiencing current

Table 2 Results of the Mantel-Haenszel χ^2 tests: Group differences (panic vs. control) with respect to the specifications of children, mothers and fathers concerning the frequency of panic-related symptoms in children, mothers and fathers

	Mantel-Haenszel χ^2	<i>p</i>
Frequency of panic-related symptoms in children		
Child report	1.48	0.22
Maternal report	0.26	0.61
Paternal report	0.58	0.75
Frequency of panic-related symptoms in mothers		
Child report	18.19	0
Maternal report	31.96	0
Frequency of panic-related symptoms in fathers		
Child report	0.05	0.82
Paternal report	2.39	0.12

panic-related symptoms, against 46 % of the mothers without PD. See Table 2 for an overview of all group differences with respect to the frequency of panic-related symptoms in children, mothers and fathers.

Association Between Maternal Panic Status (Diagnosis vs. No-diagnosis) and the Way Parents React to Children’s Panic-Related Symptoms (PCQ-C)

To test whether parental behavior in relation to children’s experience of panic-related symptoms was different between parents with and without a PD mother, four separate MANOVAs were run using maternal panic status as independent variable and learning processes associated with children’s experience of panic-related symptoms as dependent variables. Two MANOVAs were performed on children’s reports and revealed no differences between children with versus without a PD mother with respect to their perception of parents’ reaction towards their own (children’s) experience of panic-related symptoms, $F(4,77) = 0.99$, ns; $F(4,68) = 0.96$, ns. Similarly, the reports of mothers and fathers revealed no differences with respect to their own behavior in relation to their children’s experience of panic-related symptoms, $F(4,69) = 1.7$, ns (for mothers) and $F(4,44) = 0.99$, ns (for fathers). To make sure that parents’ reactions were not influenced by children’s frequency of panic-related symptoms, we checked whether parental behavior was different between children with versus without panic-related symptoms. The MANOVAs performed on the reports of children, mothers, and fathers did not reveal any differences in parental reactions between children reporting and not reporting panic-related symptoms, $F(4,76) = 1.2$, ns (for children), $F(4,66) = 0.76$, ns (for mothers) and $F(4,41) = 0.96$, ns (for fathers).

Association Between Maternal Panic Status (Diagnosis vs. No-diagnosis), the Way Parents Cope with Their Own Panic-Related Symptoms and the Degree to Which They Involve Their Children in Their Panic-Related Symptoms (PCQ-P)

Maternal Behavior and Children's Involvement in This Behavior

An overall MANOVA showed a significant difference between the reports of children with and without a PD mother on the PCQ-P, $F(4,78) = 5.90$, $p < 0.01$. Thus, children of PD mothers reported significantly more vicarious learning experiences in relation to their mothers' experience of panic-related symptoms than children of non-PD mothers. This represents a large effect size ($\eta^2p = 0.23$). Results were not significantly altered by the inclusion of child age, child current anxiety status and maternal depression as covariates. Mann-Whitney tests revealed that children with PD mothers were more prone to report observing their mothers engage in *panic-maintaining behavior* and being more *involved* in mothers' experience of panic-related symptoms than children with non-PD mothers, $U = 378$, $p < 0.01$, $r = 0.46$; $U = 553$, $p < 0.05$, $r = 0.25$. These results represent a medium and a small to medium effect size.

Consistent with children's reports, a difference was found between the reports of mothers with versus without PD on the PCQ-P, $F(4,76) = 17.63$, $p < 0.01$; meaning that mothers with PD reported significantly more vicarious learning experiences in relation to their own (maternal) experience of panic-related symptoms than mothers without PD. A large effect size was found ($\eta^2p = 0.48$). Mothers with PD reported more *panic-maintaining behavior*, more *punishment by others* and more *involvement* of their children when exposed to panic-related symptoms than diagnosis-free mothers, $U = 180$, $p < 0.01$, $r = 0.67$; $U = 354$, $p < 0.01$, $r = -0.48$; $U = 576$, $p < 0.05$, $r = 0.23$. In other words, large effect sizes were found for the differences in *panic-maintaining behavior* and *punishment* and a small to medium effect size was found for the amount of child *involvement*. Moreover, the inclusion of child age, child anxiety status or maternal depression as covariates did not change the outcome. See the first part of Table 3 for an overview of the means and standard deviations per informant (child, mother, father) and per group (mothers with PD vs. mothers without PD), regarding mothers' behavior in relation to mothers' experience of panic-related symptoms.

Paternal Behavior and Children's Involvement in This Behavior

No differences were found between the reports of children with and without a PD mother regarding the way their

fathers coped with their own (paternal) experience of panic-related symptoms and their involvement in these symptoms. Consistent with the reports of children, fathers with and without a PD partner did not perceive differences in the way they behaved towards their children and in the degree to which they involved their children in their own (paternal) experience of panic-related symptoms. See the second part of Table 3 for an overview of the means and standard deviations per informant (child, mother, father) and per group (mothers with PD versus mothers without PD), regarding fathers' behavior in relation to fathers' experience of panic-related symptoms.

Discussion

The purpose of this study was to investigate learning processes associated with panic-related symptoms in families with and without a PD mother and their children. Different types of indirect learning processes were assessed: operant learning, instructional learning and vicarious learning. In addition, we examined how strongly the child was involved in parental panic-related behavior. A multiple informant approach was used, where children, mothers and fathers reported on learning processes associated with panic-related symptoms. We first looked at parents' behavior in response to children's experience of panic-related symptoms and secondly we looked at parents' behavior in response to their own experience of panic-related symptoms. Results revealed that there was no difference in the way parents with and without a PD mother dealt with their children's experience of panic-related symptoms. However, as reported by mothers and children, mothers with PD showed more *panic-maintaining behavior* and involved their children more often in their own experience of panic-related symptoms than mothers without PD. Furthermore, mothers with PD reported being punished more often than mothers without PD when experiencing panic-related symptoms.

The results of the present study indicate that maternal panic status was not related to how children, mothers and fathers perceived the way parents reacted to their children's experience of panic-related symptoms. So, according to the reports of mothers and children, mothers with PD did not behave differently in relation to their children's experience of panic-related symptoms than mothers without PD. Similarly, paternal and children's reports revealed that fathers with PD partners did not act differently in relation to their children's experience of panic-related symptoms compared to fathers without PD partners. These results are different from the retrospective results of Ehlers [10], who found that patients with PD reported more operant learning experiences in childhood in the context of panic-related

Table 3 Means (and standard deviations) from both groups (panic vs. control) on PCQ-P (reports with respect to parents' experience of panic-related symptoms). Values and effect sizes of overall MANOVAs and Mann–Whitney tests are only provided for significant differences

	Child report				Maternal report				Paternal report	
	Mother with PD	Mothers without PD	<i>F</i> <i>U</i>	η^2p <i>r</i>	Mothers with PD	Mothers without PD	<i>F</i> <i>U</i>	η^2p <i>r</i>	Mothers with PD	Mothers without PD
Maternal behavior with respect to mothers' experience of panic-related symptoms (df)			(4,78)				(4,76)			
Overall MANOVA			5.90***	0.23			17.63***	0.48		
Reinforcement	1.96 (0.74)	1.79 (0.83)			1.52 (0.89)	1.75 (0.93)				
Punishment	0.64 (0.85)	0.46 (0.64)			0.96 (0.67)	0.29 (0.46)	354***	0.48		
Panic-maintaining behavior	1.15 (0.62)	0.50 (0.51)	378***	0.46	1.15 (0.55)	0.22 (0.42)	180***	0.67		
Involvement of child	1.53 (0.63)	1.14 (0.85)	553**	0.25	1.00 (0.58)	0.71 (0.60)	576*	0.23		
Paternal behavior with respect to fathers' experience of panic-related symptoms										
Reinforcement	1.62 (0.86)	1.58 (0.78)							1.65 (0.92)	1.68 (0.95)
Punishment	0.63 (0.90)	0.25 (0.44)							0.55 (0.75)	0.53 (0.69)
Panic-maintaining behavior	0.57 (0.58)	0.46 (0.59)							0.41 (0.56)	0.53 (0.61)
Involvement of child	0.93 (0.80)	1.04 (0.81)							0.57 (0.56)	0.53 (0.61)

PD panic disorder, η^2p partial eta-squared (effect-size value)

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.00$

symptoms. Reasons for this discrepancy could be linked to methodological differences: Ehlers [10] studied *retrospective* learning experiences in adults with PD, while the present study investigated *current* learning experiences in children at risk for PD. It may be that individuals with PD retrospectively restructure their memories of early learning experiences to reach a plausible and coherent explanation of their current mental health. Another explanation could be that social desirability tendencies underlie the current reports of parents and children, meaning that these results are not valid. However, across all informants—child, mother and father—no significant differences were found in parental reactions towards children's experience of panic-related symptoms in high-risk versus control children. As pointed out by a number of studies [26–30], parent–child agreement on parenting behaviors is usually poor; children typically report less healthy parenting while parents report more favorable parenting than is actually the case. In the present study, agreement between informants was good, suggesting low contamination of social desirability bias. Finally, the discrepancy between the results of the present study and the study by Ehlers [10] may be explained by the panic status of the person under investigation. While the present study investigated children who were at risk for PD, the participants in the study by Ehlers [10] suffered from a full-blown PD. It can be hypothesized that parents of children with a full-blown PD react differently towards panic-related symptoms in their children

compared to parents of children at risk. This hypothesis has to be tested directly by comparing groups of children with PD and children at risk. In summarizing the results of this study, there is first evidence that operant and instructional learning in the context of panic-related symptoms may not play a role in high-risk children for PD.

With regard to the way parents coped with their own experience of panic-related symptoms, family members' reports revealed an association between maternal panic status and maternal behavior but not paternal behavior. Children of mothers with PD reported to observe more often panic-maintaining behavior in their mothers and being more involved in their mothers' experience of panic-related symptoms than children of mothers without PD. Consistent with their children's perception, mothers with PD were more likely to report panic-maintaining behavior, as well as to involve their children more often in their own experience of panic-related symptoms than mothers without PD. Interestingly, mothers with PD reported receiving more punishment regarding their own panic-related symptoms than mothers without PD. However, this perception was not shared by their children. It is possible, that mothers with PD are strongly critical of their own experiences of panic-related symptoms. All in all, these findings confirm those of Ehlers [10], showing that participants with panic attacks more often than controls observed sick-role behaviors regarding panic symptoms in their parents. In accordance with the results of Ehler's study [10], the

present study found that children of mothers with PD were more likely to observe panic-maintaining behavior in their mothers and to be more involved in their mothers' experience of panic-related symptoms than children of mothers without PD. A strength of the present study lies in the fact that child report was confirmed and thus validated by maternal report. In summarizing the results of the present study and the study by Ehlers [10], it can be argued that vicarious learning might play an important role in the etiology of panic disorder.

Although the current study extends earlier research by using a multiple informant approach and by including a high-risk sample of children of mothers suffering from PD, it has several noteworthy limitations. (1) The present study relied on current self-report data. Although we circumvented the problem of recall bias by assessing family members' current perceptions, self-report measures, just like direct observation, are sensitive to fake-good behavior and socially desirable answering tendencies. Moreover the validity of the questionnaire used to assess learning experiences associated with panic-related symptoms needs further investigation. In particular, it needs to be shown that the punishment and reinforcement questions are actually aversive and rewarding. Furthermore, it has to be tested whether the questions related to reinforcement and support can be distinguished from one another. (2) The current study does not explain whether vicarious learning may be a risk factor and play a causal role in the etiology of panic disorder. This can only be investigated by using an experimental or prospective longitudinal approach. (3) The age-range of the children was quite variable (10–22 years), including nearly all developmental stages from childhood to young adulthood; this wide-age range raises the question of whether the frequency of symptoms reported by children and the parental responses to these panic-related symptoms might have been different between younger and older children. Future studies should therefore attempt to examine specific developmental stages (children, adolescents or young adults) in order to elucidate whether learning experiences are different across age groups. Moreover, despite the fact that we controlled for child age and did not find such differences (child age predicted about 6 % of the percentage in variance, $\eta^2 p = 0.06$), the relatively old mean age of the children ($M = 16$ years) might have influenced the direction of the results. However, this has to be tested in a next study with younger children. (4) The generalizability of the results is limited since we did not include a control group with mothers suffering from other mental disorders than PD. Consequently, the specificity of the findings remains unclear.

Finally, findings from the current study have some implications for future research in this area. Having confirmed that mothers with PD tend to show more panic-

maintaining behavior (e.g., avoidance of bodily symptoms, selective attention to panic-related symptoms) and involve their children more in their own experience of panic-related symptoms, reinforces the need for a better theoretical and empirical understanding of the relationship among learning experiences, panic-related symptoms and the development of anxiety disorders. If a child learns to fear somatic symptoms through parental reactions to the child's or parents' anxiety symptoms, such learning experiences could place the child at risk for the development of panic attacks and PD in adulthood [10]. A better understanding of the learning pathways to panic-related symptoms should enable directly targeting at-risk individuals. Nevertheless, current findings were based on last-born children as well as children of single families, raising the question about the possible impact of maternal panic status on various siblings. Maternal panic status may affect younger and older siblings differently and parents may respond differently to older versus younger siblings' behaviors; therefore, sibling order should be carefully considered in future studies investigating learning experiences associated with anxiety disorders. Findings of the present study may also have implications for the prevention and treatment of panic disorders. If vicarious learning plays an important role in the etiology of panic disorder, the next challenge is to show that successful treatment of parental panic disorder may put children of parents with panic disorder at a lower risk for the development of panic disorder.

Summary

The present study examined learning processes involved in the transmission of panic disorder (PD). For this purpose, families with versus without PD mothers were compared to investigate the relation between maternal PD and learning mechanisms associated with panic-related symptoms. Eighty-six Mothers (of whom 58 had a primary diagnosis of PD), their partners and teenage children (mean age, 16.67 years) were asked to fill in a two-part questionnaire. First parents and children reported about parental behavior with respect to children's experience of panic related symptoms (operant learning and instructional learning) and in a second attempt they reported about parental behavior with respect to parents' experience of panic related symptoms (modeling) and the involvement of children in this behavior. The results revealed no differences in the way parents reacted to their children's experience of panic related symptoms; however mothers and children reported that mothers with PD were more prone to engage in panic-maintaining behavior as well as to involve their children in their own experience of panic-related symptoms than mothers without PD. In other words, preliminary results

indicate that mothers with PD might put their children at a higher risk of developing panic attacks by maintaining their own experiences of panic-related symptoms and by involving their children in this behavior, thus by modeling panic-like behavior.

Acknowledgments This research was supported by the German Ministry of Science, Research and Education DLR grant 01 EG 9731/4 and is part of the National Centre of Competence in Research (NCCR) Swiss Etiological Study of Adjustment and Mental Health (sesam) funded by the Swiss National Science Foundation (SNF) (project no. 51A240-104890). The study received ethical permission from the German Association of Psychology. We gratefully acknowledge Helen Vollrath for English proofreading.

References

- Barlow DH (2000) Unraveling the mysteries of anxiety and its disorders from the perspective of emotion theory. *Am Psychol* 55:1247–1263
- Barlow DH (2002) Anxiety and its disorders: the nature and treatment of anxiety and panic, 2nd edn. Guilford Press, New York
- Bouton M, Mineka S, Barlow DH (2001) A modern learning theory perspective on the etiology of panic disorder. *Psychol Rev* 108:4–32
- Chorpita BF, Barlow DH (1998) The development of anxiety: the role of control in the early environment. *Psychol Bull* 124:3–21
- Rachman S (1977) The conditioning theory of fear-acquisition: a critical examination. *Behav Res Ther* 15:375–387
- Beidel DC, Turner SM (1997) At risk for anxiety: psychopathology in the offspring of anxious parents. *J Am Acad Child Adolesc Psychiatry* 36:918–924
- Rapee RM (2002) The development and modification of temperamental risk for anxiety disorders: prevention of a lifetime of anxiety? *Biol Psychiatry* 52:947–957
- Field AP, Ball JE, Kawycz NJ, Moore H (2007) Parent-child relationships and the verbal information pathway to fear in children: two preliminary experiments. *Behav Cogn Psychoth* 35:473–486
- Fisak B, Grills-Taquechel AE (2007) Parental modeling, reinforcement, and information transfer: risk factors in the development of child anxiety? *Clin Child and Fam Psychol* 10:213–231
- Ehlers A (1993) Somatic symptoms and panic attacks: a retrospective study of learning experiences. *Behav Res Ther* 31:269–278
- Field AP, Agyris NG, Knowles KA (2001) Who's afraid of the big bad wolf: a prospective paradigm to test Rachman's indirect pathways in children. *Behav Res Ther* 39:1259–1267
- Field AP, Hamilton SJ, Knowles KA, Plews EL (2003) Fear information and social phobic beliefs in children: a prospective paradigm and preliminary results. *Behav Res Ther* 41:113–123
- Field AP, Lawson J (2003) Fear information and the development of fears during childhood: effects on implicit fear responses and behavioral avoidance. *Behav Res Ther* 41:1277–1293
- Field AP, Lawson J, Banerjee R (2008) The verbal threat information pathway to fear in children: the longitudinal effects on fear cognitions and the immediate effects on avoidance behavior. *J Abnorm Psychol* 117:214–224
- Cobham VE, Dadds MR, Spence SH (1999) Anxious children and their parents: what do they expect? *J Clin Child Psychol* 28:220–231
- Watt MC, Stewart SH, Cox BJ (1998) Anxiety sensitivity mediates the relationships between childhood learning experiences and elevated hypochondriacal concerns in young childhood. *J Psychosom Res* 49:107–118
- Muris P, Merckelbach H, Meesters C (2001) Learning experiences and anxiety sensitivity in normal adolescents. *J Psychopathol Behav Assess* 23:279–283
- American Psychiatric Association (1994) Diagnostic and statistical manual of mental disorders, Fourth Edition. DSM-IV. American Psychiatric Press, Washington, DC
- Margraf J (1994) Diagnostisches Kurz-Interview bei psychischen Störungen [Short diagnostic interview for mental disorders] (Mini-DIPS). Springer, Berlin
- Margraf J, Schneider S, Soeder U, Neumer S, Becker ES (1996) Diagnostisches Interview bei psychischen Störungen (Forschungsversion) [Diagnostic interview for mental disorders (research version)] (F-DIPS). Unpublished manuscript, Technische Universität Dresden
- Margraf J, Schneider S, Ehlers A (1991) DIPS: diagnostisches Interview bei psychischen Störungen (diagnostic interview for mental disorders). Springer, Berlin
- DiNardo PA, Brown TA, Barlow DH (1994) Anxiety disorders interview schedule for DSM-IV lifetime (ADIS-IV-L). Graywind Publications Incorporated, New York
- Keller A (2000) Die Klassifikation psychischer Störungen nach DSM-IV mit Hilfe eines strukturierten diagnostischen Interviews (F-DIPS) [The classification of mental disorders with help of a structured diagnostic interview (F-DIPS)]. Unpublished doctoral dissertation, Ruprecht Karls University of Heidelberg, Germany
- Schneider S (1995) Psychologische transmission des paniksyndroms (psychological transmission of panic disorder). Auer, Donauwörth
- Akritas MG (1991) Limitations of the rank transform procedure: a study of repeated measures designs, Part I. *J Am Stat Assoc* 86:457–460
- Bögels SM, van Melick M (2004) The relationship between child-report, parent self-report, and partner report of perceived parental rearing behaviors and anxiety in children and parents. *Person Indiv Diff* 37:1583–1596
- Bögels SM, van Oosten A, Muris P, Smulders D (2001) Familial correlates of social anxiety in children and adolescents. *Behav Res Ther* 39:273–287
- Caster JB, Inderbitzen HM, Hope D (1999) Relationship between youth and parent perceptions of family environment and social anxiety. *J Anxiety Disord* 13:237–251
- Houweling JEG, Schneider S (in press) Perceived intra-familial connectedness and autonomy in families with and without an anxious family member: a multiple informant approach. *Child Fam Behav Ther*
- Tein J-Y, Roosa MW, Michaels M (1994) Agreement between parent and child report on parental behaviours. *J Marr Fam* 56:341–355