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Exploring the Intergenerational Transmission of Illness Behavior: From Observations to Experimental Intervention

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Abstract

Background—Functional abdominal pain (FAP) of childhood is characterized by, among other things, pain with no known physiological cause, and family patterns of related disorders have been reported.

Purpose—The purpose of this paper is to trace the development of one FAP research program and highlight some of its key findings from observations of interaction patterns to intervention studies designed to test outcomes of altering these patterns.

Methods—Studies summarized include observational and experimental research.

Results—Parental response to child pain behaviors appears to be a key factor in the development and maintenance of FAP, and intervention which includes targeting changes in parental responses can decrease reports of pain and other illness behaviors.

Conclusions—Research into FAP can provide valuable information for not only FAP and other unexplained pain conditions, but other medical conditions where environmental responses may play an important role in their etiology and maintenance.

Keywords

Functional abdominal pain; Illness behavior; Intergenerational transmission

Introduction

The purpose of this paper is to overview one of the major research directions of our group over the last several years. This line of work spans a period that began with early observations of the phenomenon of intergenerational patterns of illness behaviors, progressed to research into explorations of the possible mechanisms for this phenomenon, and continued on to testing interventions that would enhance adaptive responses by children to their health experience.

Illness Behavior

How people react to health conditions, both acute and chronic, has sometimes been described as “illness behavior,” i.e., the way people perceive and react to somatic sensations which might signify disease [1]. Inappropriate illness behavior has several forms. In one extreme, an individual may fail to notice sensations indicative of a serious condition requiring attention or refuse to let even serious symptomatology interrupt his or her normal routine. The other extreme may result in misinterpretation of normal somatic sensations as symptoms of disease and seeking unnecessary medical treatment for minor complaints. Both ends of the continuum are of concern to health care providers: Denial may lead individuals to postpone diagnostic investigations or not to engage in activities which would improve well-being. Preoccupation with illness, on the other hand, creates a costly burden on the individual and even the health care system [2]. In the case of children, inappropriate parental reactions to children’s expressions of discomfort may also contribute to a worsening of the disease experience and possibly even worsening of the disease itself [3]. Our research focuses on increasing appropriate and decreasing inappropriate illness behaviors in response to somatic sensations.

Social learning theory provides a strong conceptual framework for understanding much of the development and maintenance of illness behavior. From this perspective, illness behaviors such as effective coping strategies or somatic complaints may be learned and maintained in large part because they produce social rewards [4–6]. According to this model, a patient’s illness behaviors may result in increased positive consequences for the patient, such as expressions of support, caring, or concern, or decreased negative events such as fewer demands for participation in taxing household activities or chores. This model does not imply that either direction of response indicates the symptoms of illness are not present or “real” nor does it imply a conscious attempt to manipulate such contingencies. Furthermore, it is important to emphasize that throughout this paper the term “behavior” refers to cognitive processes as well as externally observable actions.

Much of the empirical research examining this model has been conducted with patients suffering from chronic pain, where solicitous responses have been shown to be related to increased pain, activity, and disability [7–11]. While direct causal relationships are difficult to establish in such research, this theoretical model may account in part for the perpetuation of dysfunction and the excess disability seen in many patients with chronic pain, and possibly other chronic conditions, where the level of dysfunction appears to exceed that expected from observed pathophysiology.

Our group has found that the functional gastrointestinal disorders (FGIDs) provide an excellent opportunity for exploring the illness behavior phenomenon in general, and the intergenerational transmission of illness behavior in particular. Much of our work has focused specifically on functional abdominal pain disorders of childhood. Functional abdominal pain is characterized by abdominal pain with “no evidence of an inflammatory, anatomic, metabolic, or neoplastic process considered likely to be an explanation for the subject’s symptoms.” [12]. Our cross-generational studies have also looked at the occurrence of irritable bowel syndrome (IBS) in adults/parents. Similar to the childhood

FGIDs, IBS is a common, chronic abdominal pain condition that also *cannot be explained by anatomic abnormalities*. Furthermore, while we have focused on unexplained abdominal pain, we believe that what is learned within this arena can provide a useful model for illness behavior in general across a wide range of medical problems.

The primary goals of this investigative line have been to address the following questions:

1. How does pain develop in children when no physiological cause for the pain is evident?
2. How can we reduce/eliminate/prevent it?

This paper will begin by first summarizing many of our observational findings on children with medically unexplained abdominal pain. Topics covered include family illness patterns, genetics explorations, and familial traits associated with childhood abdominal pain. The paper will then present our explorations into possible mechanisms for familial patterns. Subsequently, findings from our experimental research aimed at altering these patterns will be presented.

Observational Studies

Familial Patterns: Children of IBS Parents

Several studies have demonstrated that health beliefs and health care utilization patterns tend to run in families. Wilcox-Gok [13] found the behaviors of siblings predicted children's health care visits and days missed of usual activities. Lewis and colleagues [14] also found that children's utilization was predicted by their mothers' utilization, and Schor et al. [15] found, in families enrolled in a prepaid health plan, significant correlations in uses of services among family members, especially at the extremes of usage. These familial utilization rates were correlated over 6 years of follow-up.

Whitehead and colleagues [4, 16] proposed that childhood social learning contributes to the development of irritable bowel syndrome (IBS); specifically, they suggested that when parents provide toys or gifts or special privileges to children who complain of gastrointestinal (GI) symptoms, they are reinforcing somatic complaints, and that when parents exhibit illness behavior when they are ill by avoiding unpleasant tasks and by expecting special consideration, they model illness behavior which their children emulate (model). In support of this learning hypothesis, Whitehead and colleagues reported [16, 17] that when IBS patients were asked how their parents responded to illness complaints during childhood, they were more likely than participants without IBS to recall that their parents provided gifts or special privileges. The adult participants with IBS were also more likely to recall that their parents exhibited illness behavior. These findings were supported by an independent study of adult IBS patients by Lowman et al. [18].

A weakness of these studies was their dependence on retrospective recall, although Whitehead et al. [17] did show that the reports of adult women about how their parents behaved in relation to illness were consistent with the independent reports of their mothers. The aim of our study [19] was to use objective data on health care visits and costs taken from the administrative database of a large health maintenance organization to investigate

the relationship between parents' and children's utilization patterns. We examined the specificity of the effects of the intergenerational transmission of gastrointestinal illness behavior by (1) comparing the children of IBS patients to control children whose parents did not have IBS and (2) statistically controlling for differences between the IBS parents and non-IBS parents in the frequency of non-gastrointestinal health care visits.

In our study, participants were drawn from the membership of a large HMO. We identified case families from the administrative database in whom at least one parent had been treated for a diagnosis of IBS and who had at least one child aged 3 to 14. A matched control group was selected from the same population. Control parents were not treated for a diagnosis of abdominal pain, constipation, diarrhea, dyspepsia, or GI motility disorder during the same year. Families were matched on the age and gender of the IBS parent, as well as number of children in the family. The final sample consisted of 373 case parents, 631 case children, 382 control parents, and 646 control children. Seventy percent of the parents and 49% of the children were female. The mean parent age was 39 years, and the mean age for children was 9 years. Health care utilization records were obtained from the HMO's automated database for all study children on the frequency, type, and diagnosis of all health care visits for the three consecutive years of the study.

Case children had significantly more ambulatory visits than control children (mean 12.26 vs. 9.81; $t=5.94$, $p=0.0001$). This was also true for all health care costs ($t=3.17$, $p=0.0001$), ambulatory visits for GI symptoms (abdominal pain, diarrhea, constipation; $t=5.144$, $p=0.0001$), and emergency room visits ($t=2.171$, $p=0.03$). When GI visits were further subclassified, case children were found to make more outpatient visits for abdominal pain ($t=3.71$, $p=0.0002$) and diarrhea ($t=4.094$, $p=0.0001$) based on the diagnosis assigned by the care provider at the time of the visit. Outpatient health care costs over the 3-year period were also significantly higher for case than control children ($t=3.17$, $p=0.0001$).

IBS parents made more health care visits than the control parents for non-gastrointestinal complaints, in addition to the difference in visits for IBS. They also incurred substantially higher health care costs. This suggested that IBS parents might be transmitting to their children a *general* pattern of illness behavior rather than specifically transmitting GI illness behavior.

To determine whether there was a *specific* relationship between IBS visits by parents and the visits of their children for gastrointestinal symptoms, we repeated the analyses described above, but statistically controlled for the total number of ambulatory visits of the parents, excluding gastrointestinal visits. These regression analyses revealed that case children utilized health care services more than controls for abdominal pain ($p=0.02$), diarrhea ($p=0.0004$), and for all types of gastrointestinal visits ($p=0.007$), independent of the total number of health care visits made by their parents.

One reasonable challenge to a conclusion that intergenerational transmission occurred in the previous study is that since parents control taking a child to the physician, high health care utilization might reflect the *parents'* illness behavior rather than the children's. To address this possibility, in a subsequent study [20], in addition to obtaining data from an automated

database, we conducted interviews and collected questionnaires from both parents and children. Importantly, children were interviewed separately from their parents.

Two hundred eight mothers with irritable bowel and their 296 children (cases: average age 11.9 years; 48.6% male) and 241 non-irritable bowel mothers and their 335 children (controls: 11.8 years; 49.0% male) were interviewed. This study similarly found that case children independently reported more frequent stomachaches ($F(591)=9.22, p=0.0025$) and non-gastrointestinal symptoms ($F(562)=21.03, p<0.001$) than control children. Case children also had more school absences ($F(625)=26.53, p<0.0001$), physician visits for gastrointestinal symptoms ($F(602)=8.09, p=0.005$), and non-gastrointestinal clinic visits ($F(602)=27.92, p<0.001$) than control children.

Genetics

Individuals' explanations for functional pain, and in fact any medical phenomenon, are influenced by a variety of factors. These factors can include the individuals' knowledge of the literature, personal history, professional training, and even potential for financial gain from one explanation over another (for example, a disease model is more likely to support the use of medications for treatment than a psychosocial perspective). When some audiences suggested that the similarities of illness patterns discussed above might be the result of an inherited genetic tendency toward disease, we began to explore this possibility by examining IBS concordance rates utilizing a twin registry [21].

We collected data on rates of IBS among twins from a larger study that obtained questionnaire data on the occurrence of a number of different health problems, including IBS, from a twin database. These questionnaires were sent to both members of 11,986 twin pairs. Subjects were asked, "Have you or any of your close family been affected by this disease?" There followed a list of 79 health problems common to men and women plus seven health problems specific to women and three health problems specific to men. The list included "irritable bowel syndrome." If the disorder was reported for a member of the respondent's family, they then identified which other family members experienced it (i.e., twin, father, mother, brothers, sisters, sons, and daughters).

In order to assess the relative contribution of genetic and social learning influences, we compared the probability that a twin with IBS would have a co-twin with IBS, to the probability that a twin with IBS would have a mother with IBS. We restricted the comparison to one parent in order to avoid inflating the a priori probability of a match between parent and child, and we choose the mother over the father because (a) women are more likely to have IBS than men and (b) mothers typically spend more time with their children than fathers and thus are more likely to influence the child's illness behavior through modeling. These analyses were also limited to twin pairs in which at least one twin had IBS. Independent variables in the initial regression analyses were (a) whether the twin's mother had IBS, (b) whether the twin's father had IBS, and (c) whether the co-twin reported that they had IBS.

There were 281 twin pairs in which one or both twins reported their IBS status and at least one member reported having IBS. These 281 twin pairs included 117 MZ and 164 DZ twin

pairs. Mean age of the twins at the time of completing the questionnaire was 29.9 years for the MZ twins and 30.3 years for DZ twins

The total proband concordance estimate was computed using the standard formula $(2C_2+C_1)/(2C_2+C_1+D_1)$ [22], where C_2 is the number of pairs in which both twins independently reported IBS (double ascertainment), C_1 is the number of twin pairs in which only one twin completed a questionnaire but reported both self and the co-twin to have IBS (single ascertainment), and D_1 is the number of pairs discordant for IBS, based on the reports of either both twins or only one twin. The significance of differences in concordance rates between MZ and DZ twins was tested using χ^2 analysis. For comparisons of concordance rates in MZ and DZ twins, the unit of analysis was the twin pair (not individual respondents). Stepwise logistic regression was used as a second, confirmatory method of assessing the relative contribution of heredity and social learning to IBS.

The concordance for the MZ twins was 17.2% compared to 8.4% for DZ twins ($\chi^2=4.70$, $p=0.030$). This analysis included 62 MZ and 106 DZ twin pairs in which only one twin reported for the pair, and 55 MZ and 58 DZ twin pairs in which both twins reported IBS status. When the analysis was restricted to doubly ascertained twin pairs, the results were essentially the same: concordance estimates were 16.7% for MZ and 6.7% for DZ twins ($\chi^2=2.91$, $p=0.09$). The genetic liability for a disorder can be estimated by subtracting the DZ concordance from the MZ concordance. The liability for a MZ twin having IBS given the other twin reporting IBS is estimated to be 8.8%. Concordance for irritable bowel was significantly greater ($p=0.030$) in monozygotic compared with dizygotic twins, supporting a genetic contribution to IBS.

Expanding our analysis beyond twins to parental status, we found that the probability that a DZ twin with IBS will have a mother with IBS (15.2%) was significantly greater ($p<0.001$) than the probability that a DZ twin with IBS will have a co-twin with IBS (6.7%), and the probability that an MZ twin with IBS will have a mother with IBS (17.1%) was also significantly greater ($p<0.001$) than the probability that a DZ twin with IBS will have a co-twin with IBS (6.7%).

We believe that this supports a social learning contribution to IBS because mothers share about the same number of genes with their children as DZ twins share with each other, yet the proportion of IBS twins who have mothers with IBS was significantly greater than the proportion of DZ twin with IBS whose co-twins have IBS.

Based on these findings, we concluded that heredity contributes to the development of irritable bowel syndrome, but social learning (what an individual learns from those in his or her environment) has an equal *or greater* influence. While both genetic vulnerability and environmental factors may contribute to any event, the relative contribution of each has important consequences for treatment and prevention.

Familial Traits

Another aspect of this research program investigating inter- and intra-personal influences on illness behavior sought to determine the relative contributions to medical consultation of the

psychological symptoms of the mother and child, the severity of child abdominal pain, and family stress [23].

Participant families were randomly selected from the automated database of a large health maintenance organization from all women who had one or more children between the ages of 8 and 17 and was comprised of all randomly selected families in which the children, when interviewed, retrospectively reported experiencing abdominal pain during the 2 weeks preceding the interview. This resulted in a final sample of 334 children and 275 mothers. All assessments were conducted by a single interview in the home. Mothers independently completed a battery of pencil-and-paper questionnaires (in the home, while the child was being interviewed). Child report measures assessed abdominal pain in past 2 weeks utilizing the Children's Somatization Inventory [24, 25] and perceived pain severity utilizing the Pain Beliefs Questionnaire [26]. Parent-report measures assessed maternal psychological distress by asking mothers to complete the anxiety, depression, and somatization subscales of the Symptom Checklist 90—Revised (a total of 35 items, [27]); child psychological distress with the Achenbach Child Behavior Checklist for ages 4–18 [28, 29], family stress with The Family Inventory of Life Events [30], and consultation for abdominal pain by asking mothers, “In the past 3 months, how many times did your child go to the doctor for abdominal pain?” Choices were “None,” “1–3 days,” “4–6 days,” “7–9 days,” and “10 or more days.” Children were classified as consulting a physician for abdominal pain if the response was anything other than “none.”

Logistic regression was used to determine which of four variables (abdominal pain symptom severity, maternal psychological distress, child psychological distress, and family stress) contributed significantly to consulting behavior. In univariate regressions, maternal psychological symptoms, child psychological symptoms, and perceived pain severity all predicted consultation. However, in a stepwise regression, only maternal psychological symptoms and perceived pain severity significantly predicted consultation (p values=0.006 and 0.000, respectively). Thus, a principal finding of this study was that a child's visit to the clinic for abdominal pain is best predicted by symptoms of psychological distress in the mother and severity of abdominal pain as reported by the child, *rather* than psychological distress in the child *or* family stress.

Familial Mechanisms Contributing to Illness Behavior

Two commonly discussed social learning mechanisms which could explain many of the observations found above are:

- **Modeling**—When parents stay home from work and expect special consideration (e.g., help with chores), children become hypervigilant to somatic sensations, report more symptoms, and want to stay home from school.
- **Reinforcement**—Behaviors that are rewarded are repeated. When parents pay special attention or give gifts to a child who complains of a stomachache, the complaints are likely to increase.

However, while the findings reported above could be explained by modeling, specific measures of reinforcement were needed to support the presence of a reinforcement

phenomenon. In Levy et al. [20], reinforcement was also explored by administering the Illness Behavior Encouragement Scale (IBES) [31]. Solicitous responding to gastrointestinal complaints was measured by the solicitousness subscale of the IBES that was completed by the mother. Sample questions from this scale were “When your child has a stomachache or abdominal pain, how often do you tell your child he/she doesn’t have to finish all of his/her homework?” and “...how often do you give your child special privileges or let him/her do things that he/she isn’t usually allowed to do (like staying up late or watching more TV)?”

Children with higher school absentee levels for gastrointestinal symptoms as reported by their mothers were more likely to have parents with IBS ($F(625)=26.53, p<0.0001$), who were also more solicitous in response to their child symptoms ($F(625)=5.33, p<0.05$). Significant covariates were greater child psychological symptoms ($F(157)=10.92, p<0.002$) and passive coping styles ($F(157)=5.83, p<0.02$), both of which were found to amplify the difference in school absences between case and control children. These findings (shown in Fig. 1) were confirmed by nonparametric tests: for parent IBS status, the Mann–Whitney test yielded a $Z=5.05, p<0.001$; and for solicitousness, the Kruskal–Wallis test yielded a $X^2=16.77 (p<0.001)$. After adjustment for potential moderators, the effect of parent IBS status remained significant ($F(157)=11.69, p<0.001$), and the effects of solicitousness showed a trend ($F(157)=3.16, p=0.08$). Similar patterns existed for medical visits for stomachaches and the child’s perception of the seriousness of their stomach aches.

In a related study into mechanisms of intergenerational transmission that might be related to social learning processes [32], we explored whether catastrophic thinking about pain by children with functional abdominal pain or by their parents is associated with health outcomes in the child. Participants were 132 parent–child dyads. Child catastrophizing predicted child depression, anxiety, and functional disability. Parents’ catastrophizing cognitions about their own pain predicted self-reported protective responses to their children’s abdominal pain (responding in ways that encourage illness behavior). All findings held despite controlling for child age, gender, and symptom severity. These results suggest that catastrophic cognitions play an important role in how children and parents cope and respond to functional abdominal pain. Tying this in to what was discussed in prior studies, catastrophic thinking may thus be related to what parents model and/or reinforce in their children.

Familial Experimental Research

Based on these and similar studies, a collaborator conducted a laboratory-based study [33] to determine whether instructing parents to attend to children’s symptom talk results in higher child symptom talk, especially in child pain patients. Participants were child abdominal pain patients and their parents and matched well-child controls and their parents.

Inducing discomfort utilizing a water load test [34], parents were either given no instructions, told to distract their child, or to pay attention to the symptom complaints. Results are shown in Fig. 2 and demonstrate the increasing rates of symptom talk across the three conditions for both well-child and child abdominal pain patient/parent pairs, and especially for pain patients.

Our clinical intervention study [35] sought to ask the question of whether we could take this finding out of the laboratory and into the clinic, altering children's illness behavior by teaching parents and children to respond differently.

The study was a prospective, randomized, controlled trial with blinded assessment of outcome designed to address many of the methodological limitations of prior research in this area, including small sample size, uncontrolled comparison conditions, and lack of attention to treatment fidelity. Participants included 200 children and teens, aged 7–17, with chronic abdominal pain, and their parents. Inclusion criteria were: (1) child ages 7–17 years, (2) three or more episodes of recurrent abdominal pain during a 3-month period, and (3) child and parent cohabited for the past 5 years or, in cases of divided custody, for at least half of the child's lifetime. Exclusion criteria were: (1) positive physical or laboratory findings which would explain the abdominal pain, (2) any chronic disease (e.g. Crohn's, ulcerative colitis, pancreatitis, diabetes, epilepsy, celiac sprue), (3) lactose intolerance as diagnosed by the attending physician, (4) major surgery within the past year, (5) developmental disabilities requiring full-time special education or impairing ability to communicate, and (6) non-English speaking.

Participants in both conditions continued with their regular medical care as recommended by their health care team. Following completion of assessment, all participant families were randomly assigned to either our Social Learning and Cognitive Behavior Therapy (SLCBT) or Education Support (ES) condition. Because a primary goal of this study was to test an intervention that could be easily implemented in a clinical setting, we chose to restrict our intervention to only three sessions, spaced approximately 1 week apart.

The SLCBT condition was based on two principles derived from prior research: (1) Parents who respond solicitously to the child's pain reports and parents who report gastrointestinal symptoms themselves (i.e., who may model illness behavior) tend to have children with more abdominal pain and other gastrointestinal symptoms [20] and (2) parent and children's beliefs about the significance of pain and the ways they cope with pain may influence the amount of pain the child reports. This condition consisted of three major components: relaxation training, working with parent and child to modify family responses to illness and wellness behaviors, and cognitive restructuring to address and alter dysfunctional cognitions regarding symptoms and their implications for functioning through cognitive therapy techniques. Active skill practice in session and identification and assignment of skills to practice between sessions occurred throughout the study. Many of the dysfunctional parental cognitions covered were presented in a study by Van Tilburg [36], who identified a number of parental beliefs about recurrent abdominal pain.

The ES condition was developed to provide a credible alternative condition that would control for therapist and patient time and attention. It included three sessions with the same amount of therapist contact time as SLCBT. Care was taken to include homework assignments which required similar time and effort as SLCBT assignments. The content of the ES condition focused on education about GI system anatomy and function, information about USDA nutrition guidelines, and additional food-related information, such as how to read food product labels. Therapists did not specifically endorse any specific food or diet

recommendations. The conditions were determined to be comparable with respect to subject participation and treatment fidelity.

Participants completed assessments at baseline (1 week prior to treatment and prior to knowledge of treatment condition assignment), 1 week post-treatment, 3 months post-treatment, and 6 months post-treatment. At all assessment points, parents were mailed a packet of questionnaires to complete on their own and mail back. Children completed assessments via telephone. A number of measures were used in this study, but the primary measures covered in the presentation and this paper consisted of:

1. Pain was assessed by the Faces Pain Scale—Revised [37]. This scale consists of six line drawings of faces showing gradual increases in pain expression. The data reported here is on the current pain item: “Choose the face that shows how much you hurt right now.” Ratings were made independently by children with respect to their own pain and parents with respect to their child’s pain.
2. GI symptoms were assessed using the GI symptom subscale of the Children’s Somatization Inventory [24, 38, 39]. Seven items (nausea or upset stomach, constipation, loose bowel movements or diarrhea, stomachaches, vomiting, feeling bloated or gassy, and food making you sick) are rated for severity during the past 2 weeks using a 0–4 scale by asking, “In the last 2 weeks, how much were you bothered by each symptom?” Response options were “not at all,” “a little,” “some,” “a lot,” and “a whole lot.” Children rated the items with respect to their own symptoms, and parents rated the items with respect to their child’s symptoms.
3. Parental solicitousness in response to pain behavior was measured using the protectiveness subscale of the Adults’ Responses to Children’s Symptoms [40, 41]. This questionnaire is a variation of the IBES, utilized in a prior study discussed above. Ratings are made on a 0–4 scale, with higher values indicative of greater solicitousness.

Our results (shown in Fig. 3) showed that children in the cognitive behavioral condition showed greater baseline to follow-up decreases in pain and GI symptom severity (as reported by parents) than children in the comparison condition (time $\times$ treatment interaction, $p < 0.01$). Also, parents in the cognitive behavioral condition reported greater decreases in solicitous responses to their child’s symptoms compared with parents in the comparison condition (time $\times$ treatment interaction, $p < 0.0001$).

Summary and Conclusions

In summary, the data from this line of research on the relationship between environmental influences and child illness behavior suggest that:

- Children’s illness behavior/reported pain is related to the behavior of their parents’—and learning seems to account for much of this behavior.
- Children and adult illness behavior/reported pain is related to environmental response.

- Threat appraisals or catastrophic thinking about pain or symptoms by children with functional abdominal pain or by their parents is associated with health outcomes.
- Reported pain and other symptoms can be altered by changing parent and child responses to illness behavior.

Figure 4 outlines the conceptual model that forms the basis for this work and suggests a number of research and clinical opportunities.

Within this model, the first event in the chain is for an individual (1) to have a physiological sensation and either notices it or not notice it. (2) Next, if the sensation is noticed, the individual may take action (e.g., activities may be curtailed, the sensation may be reported to others, and/or medical care may be sought), and finally, (3) if action is taken, the environment may respond in a way that either increases or decreases the future likelihood of illness behavior. It should be noted that all arrows on the left side of the model are bidirectional.

Some areas for possible research and intervention suggested by the model include areas of all bidirectional arrows on the left of the model:

- Psychosocial factors that may be related to whether a sensation is even noticed or acted upon if noticed
- Parent and child cognitions if a sensation is noticed
- Parent modeling and parent (and child) responses prior to or following an action in response to the sensation

Utilization of this model can form a basis for understanding and reducing adverse, and often severe, consequences from maladaptive responses to health experiences.

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Fig. 1.
Maternal solicitousness (reinforcement) and parental IBS related to school absences

Fig. 2.

Symptom talk across three laboratory conditions. This figure has been reproduced with permission of the International Association for the Study of Pain® (IASP®). The figure may not be reproduced for any other purpose without permission (Walker, LS, Williams, SE, Smith, CA, Garber, J, Van Slyke, DA. (2006). Parent attention versus distraction: Impact on symptom complaints by children with and without chronic functional abdominal pain. *Pain*, 122(1–2), 43–52)

Fig. 3.

Current pain. Reprinted by permission from Macmillan Publishers Ltd: American Journal of Gastroenterology (Levy, RL, Langer, SL, Walker, LS, Romano, JM, Christie, DL, et al. (2010). Cognitive behavioral therapy for children with functional abdominal pain and their parents decreases pain and other symptoms. *American Journal of Gastroenterology*, 105, 946–56)

Fig. 4.
Model with research and intervention opportunities