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Recognizing Early Regulation Disorders in Pediatric Care: The For Healthy Offspring Project

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

ABCDEF G 1 **Noémi Scheuring**
ABCDEF 2 **Ildikó Danis**
BDEF 1 **Eszter Papp**
BDEF 3 **Pálma Benedek**
BDEF 4 **Tünde Németh**
BCDEF 1 **Ágnes Gulácsi**
ABCDEF 1,5 **László Szabó**

1 Department of Pediatrics, Heim Pál National Pediatric Institute, Budapest, Hungary
2 Institute of Mental Health, Semmelweis University, Budapest, Hungary
3 Department of Otolaryngology, Heim Pál National Pediatric Institute, Budapest, Hungary
4 Department of Pediatrics, Dr. Halász Géza Medical Center, Dabas, Hungary
5 Department of Family Care Methodology, Faculty of Health Sciences, Semmelweis University, Budapest, Hungary

Corresponding Author: László Szabó, e-mail: szabo.laszlo.md@gmail.com

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Background: Regulation disorders are already apparent in infancy. The For Healthy Offspring Project was the first Hungarian study aimed at building an effective model for screening and examining the prevalence and complex (medical and psychosocial) background of classic behavior regulation disorders (excessive crying, feeding, and sleep problems) in infancy.

Material/Methods: Data were collected from families of 0- to 3-year-old children in a pediatric hospital and its neighboring areas through questionnaires, medical examinations, and individual and small-group consultations.

Results: In the questionnaire study about their children's behavior (n=1133), 15% of mothers reported excessive crying, 16% reported feeding problems, and 10% reported sleep problems. In a subsample (n=619) in which medical examinations were also conducted, the prevalence of medical diagnoses was 15.0% for excessive crying, 15.2% for sleep disorders, 10.3% for breastfeeding difficulties, and 14.8% for feeding disorders. Children who were referred to the screening program (n=183) had significantly more behavior regulation disorders than the other children in our study. Regulation disorders were found to be comorbid with other health conditions in some cases.

Conclusions: We developed a complex model to screen for regulatory problems in early childhood. This study adds more information about the relationship between regulation problems and other health conditions. The general incidence (5-15%) of early childhood regulation disorders in other countries is likely similar to that found in Hungary. In order to effectively recognize early regulation disorders, diagnostic instruments widely used in the international field should be adapted in general Hungarian pediatric care.

Keywords: **Crying • Feeding Behavior • Infant Behavior • Sleep Disorders**

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Background

Emotional and behavior regulation disorders in infancy and toddlerhood are quite frequent, with an occurrence of 5-20% in a normal population [1-5]. Primary or classic regulation disorders ("the classic triad"), such as excessive and persistent crying and sleep and feeding disorders, are already seen in early infancy and can also be recognized and diagnosed in primary care [1,6-10]. According to the framework of developmental psychopathology [11], in most cases, the cumulative combination of somatic, interactional, and psychosocial environmental risk factors and a lack of significant protective factors leads to problematic behaviors associated with several types of early mental health problems [10]. Similar to other early childhood mental health problems, the background of regulation disorders is also assumed to be influenced by complex mechanisms, whereby the individual physical and psychological characteristics of the parents and the children, their common early history (pregnancy, birth, early care), the actual parent-child interactions, and the developing relationships serve as key proximal mediators of more complex distal factors, such as the sociodemographic situation, family structure, stressful life events, and social support. Naturally, the manifestation of certain problems can depend on other moderating factors, such as the age, sex, and temperament of the child [1,12].

This clinical area is specifically located at the juncture of medicine, psychology, and education, and it therefore requires an interdisciplinary approach and handling. The risk factors that compromise childhood development, parent-child interactions, and family functioning and the protective factors that support resilient development are important issues to be borne in mind in both research and clinical practice [13]. Since most of the relevant literature comes from small-sample studies, continued research is needed with larger samples to further explore the clinical significance of regulation disorders [14]. In the meantime, the findings as a whole highlight the paucity of evidence about this group of infants and the need to prioritize them for research and clinical work [15].

The study, screening, and treatment of early childhood mental health problems have a decades-long history in international practice, but the investigation of such disorders, as well as the related prevention and intervention activities, remains an understudied area in Hungary. To date, only a few national private and public initiatives have expressed interest in developing this area. The For Healthy Offspring Project, initiated by the Heim Pál National Pediatric Institute in Budapest, was the first Hungarian research to establish an effective hospital model for screening and to examine the prevalence of emotional and behavior regulation disorders in early childhood (0-3 years) and the significance of different risks and protective factors behind them. We hypothesized that the prevalence

of regulation disorders in Hungary is similar to that in other countries. We also hypothesized that the association between excessive crying and sleep disorders is strong. We developed a complex model to screen for regulatory problems in early childhood.

In this article, our aims were to (1) introduce the model of our screening program and our large-sample hospital research, (2) report the occurrence of major regulation disorders (excessive crying, sleep and feeding problems) in our sample, and (3) report associations between regulation disorders and other examined medical diseases.

We hypothesized that (1) the prevalence of regulation disorders in our Hungarian sample is similar to that of other countries, (2) the associations between excessive crying, sleep and feeding disorders are significant, and (3) these regulation problems may also be moderately associated with other diseases.

Material and Methods

Families of 0- to 3-year-old children with eating or sleeping problems or extreme crying from 3 departments of the Heim Pál National Pediatric Institute in Budapest and neighboring areas were included in this study. Data were collected from July 2010 to June 2011 in a cross-sectional design study.

We obtained information about early childhood regulation disorders from 4 sources, including questionnaires, medical examinations, and individual and small group consultations.

The model of the screening process, the data collection, and the administration of the For Healthy Offspring project are shown in **Figure 1**.

During the research period, we recruited from among all families with children under 3 years of age (n=1855) within 3 departments of the hospital, and 580 families volunteered to participate. This represents a response rate of 31.4%. During the same period, we also collected data (n=584) with the help of health visitor nurses in neighboring areas. The nurses mainly administered the questionnaires to the families with whom they visited spontaneously during their work or who visited them during their consulting hours. Thus, both subsamples were specific and selective in terms of willingness to participate and motivation to share concerns. We hypothesized that hospital rates underrepresent the real incidence of regulation disorders, while area rates overrepresent them.

In summary, in our sample, the inclusion criterion was age under 3 years among those children who visited the 3 hospital departments or lived in neighboring areas. There were

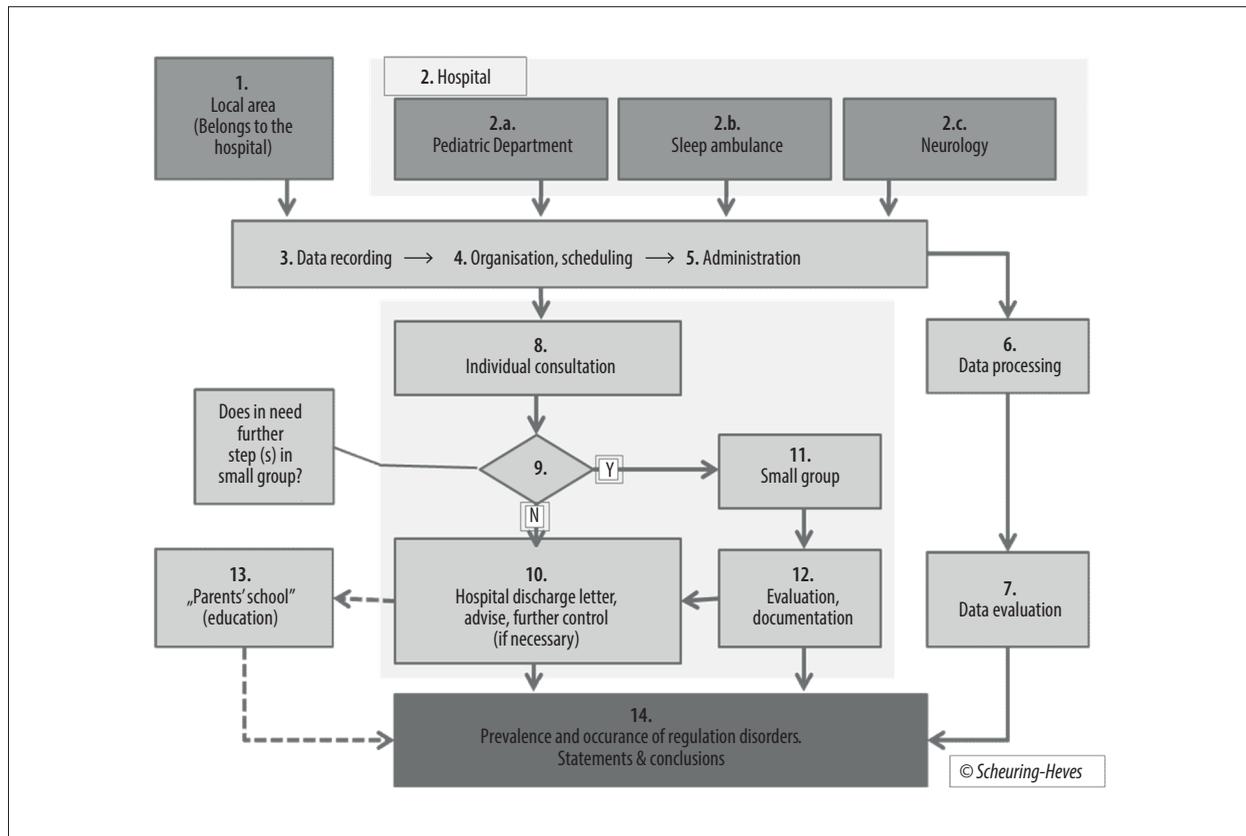


Figure 1. The model of the data collection and the analyses in the For Healthy Offspring project.

no exclusion criteria. Data collection could be biased by some methodological issues such as willingness to participate and motivation to share concerns.

Although our sample was not representative, it was nevertheless adequately heterogeneous in all relevant sociodemographic characteristics (Table 1).

Questionnaires were given to parents (n=1164) by doctors and nurses working in 3 departments (Pediatric, Sleep, and Neurology) of the Heim Pál National Pediatric Institute (n=580) and also by health nurses and general practitioners in local areas (n=584). Mothers responded in 1133 cases.

Medical examinations and/or diagnostic evaluations were performed in 619 cases.

When completing the questionnaire, the parents were offered a complex screening program (a longer medical consultation) in our hospital if any of the most common behavior regulation disorders were present in the child. A total of 183 families took part in this complex diagnostic evaluation.

Afterwards, 35 parent-infant dyads also took part in small-group consultations. For some families, individual consultations

and psychotherapy were recommended with the support volunteer hospital or other institutional professional. The process and professional content of the Screening Program are described below.

The Screening Program: Diagnostic Evaluation

Medical Consultation

Medical consultation (performed by NS and EP) consisted of a focused, detailed history taking that was followed by a physical examination. During the physical examination, healthy somatic, motor, and psychosocial developmental signs were carefully considered. In most cases, both parents were present when the child was examined; however, in a few cases, only the mother was present. The consultation normally lasted 1 h.

History taking started with the discussion of the symptom(s) that the parents had concerns about, and it was followed by general pediatric questions. To obtain broader knowledge of circumstances, certain aspects of the child's psychiatric history (birth circumstances, pregnancy, perinatal period, early sensory-motor and mental development, family sociodemographic characteristics) were also included. In all cases, the primary consideration was to determine the organic causes

Table 1. Demographic variables*.

| Variable | Sample of mothers who filled in the questionnaires (N=1133) | Subsample where medical examinations were also conducted (n=619) |
|--------------------------------------|---|--|
| | Percent/mean (SD) | Percent/mean (SD) |
| Child's gender | | |
| Boy | 52.7% | 55.2% |
| Girl | 47.3% | 44.8% |
| Child's age (months) | | |
| 0-2 | 15.3 (10.8) | 15.02 (11.07) |
| 3-5 | 9.7% | 12.1% |
| 6-8 | 14.9% | 15.9% |
| 9-11 | 10.1% | 8.5% |
| 12-17 | 10.6% | 10.3% |
| 18-23 | 16.0% | 15.4% |
| 24-36 | 13.2% | 12.0% |
| 24-36 | 25.4% | 25.7% |
| Number of children in the family | | |
| No siblings | 1.7 (0.9) | 1.7 (0.9) |
| 1 sibling | 52.7% | 52.4% |
| ≥2 siblings | 35.5% | 35.8% |
| Oldest | 11.8% | 11.8% |
| Second | 58.3% | 57.6% |
| Multiple | 31.6% | 31.6% |
| Multiple | 10.1% | 10.8% |
| Age of Mother (years) | | |
| ≤25 | 32.0 (5.1) | 31.7 (5.3) |
| 26-30 | 10.5% | 11.9% |
| 31-35 | 25.6% | 25.1% |
| 36-40 | 40.0% | 40.3% |
| ≥40 | 20.2% | 19.4% |
| ≥40 | 3.7% | 3.3% |
| Married/in common-law marriage | | |
| | 93% | 90.7% |
| Maternal education | | |
| Maximum elementary or skilled worker | 17.7% | 20.6% |
| High school | 34.9% | 34.0% |
| Postgraduate/College degree or more | 47.3% | 45.4% |
| Employed | 66.2% | 65.2% |

* Frequencies for valid answers. The proportion of missing values is 0-5%.

of the symptoms. If no physical abnormalities were found, we assumed the causative effect of psychosocial factors.

Diagnostic Evaluation of Organic Causes, Differential Diagnosis

The results of the first consultation determined the subsequent diagnostic steps. Diagnostic evaluation of the organic causes was performed depending on the presence of abnormal findings. Examinations were performed at the Pediatric Department as an outpatient service and included laboratory tests and radiological imaging tests. In some cases, specific examinations were performed by a gastroenterologist, neurologist, otorhinolaryngologist, ophthalmologist, or cardiologist. An obstructive sleep apnea symptoms test and, in cases of indeterminate symptoms of the infant or the presence of apnea, polysomnographic monitoring combined with esophageal pH monitoring was performed (by PB) at the Sleep Ambulance by Somnoscreen Plus (SOMNOmedics, GmbH, Randersacker, Germany). The following symptoms of unspecified/unexplained origin, usually with no underlying medical condition, were found: periodic breath-holding spells or strange breathing sounds, change of skin tone, loss of consciousness, loss of postural tone, and seizure. A complex motor evaluation of the infant was completed by a physiotherapist.

In cases of medical illness, our work was based on general pediatric diagnostic steps. We had more difficulty diagnosing early behavior regulation disorders. The International Classification of Diseases, 10th Revision (ICD-10) [16], which is used in Hungary, does not include clear directions about early childhood regulation disorders. In the differential diagnostics of regulation disorders, we relied on the principles of the German system, as described by Hédervári-Heller [17] in Hungarian and German, although it is not widely used in Hungary. Moreover, we greatly profited from reviewing the classification criteria of the Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood – Revised (DC: 0-3R) [18], which was not used in Hungary at that time.

Small Group Consultation

As long as no organic abnormality was found, part of the sample was offered a small-group consultation. These consultations took place in the presence of the parents (or only the mothers) and the infants on 2 occasions, each lasting 90 min. The consultations were conducted by a pediatric psychotherapist (TN) with the participation of psychologists and psychiatrists from the hospital. During the small-group consultations, the following aspects were spontaneously observed: (a) infant's developmental level and the quality of his or her playing activity; (b) quality of the parent-infant interactions; (c) emotional reactions between the parents and their moods

while together; (d) parent-infant attachment patterns based on the balance between exploration and attachment behaviors; (e) infant's attitude toward the parents and the professionals in attendance; and (f) ambience of the consultation meeting. At the end of the second meeting, the experiences were discussed with the families in a private meeting, and individual therapy for the parents or parent-infant consultations were offered if necessary. As professionals worked together in a team, they decided by consensus if regulation problems were present and whether additional care was needed due to psychosocial, relationship, or interaction difficulties. In many cases, the 2 small-group consultations were sufficient to resolve mild regulation difficulties.

Measuring Instruments

Questionnaires

A questionnaire package was specifically designed for this study. In our edited basic questionnaire, the parents were asked in detail about their family background, housing and job circumstances, their financial status, their health, health-related and psychological characteristics of the pregnancy and the birth of the examined infant, the newborn period, breastfeeding and early care, the infant's physical and mental condition, and his or her behavioral characteristics. We then focused on the 3 main areas of regulation disorders. Detailed questions were asked about each topic to determine if the infant was affected by intense crying and restlessness, feeding and weight gain difficulties, or sleep disorders. Most of the questions were closed-ended, discrete questions with 2 or more possible answers, or Likert-type scale items, usually with 5 levels. Only the "other" questions were open ended. A pilot study was conducted to ensure that the questions were well understood by the respondents and could be answered easily and reliably. We were not able to measure internal consistency because these questions were single items and did not form scales. In this article, we used only the socio-demographic information and some Likert-type questions on early regulation (crying, sleep, and feeding).

Medical Diagnoses

The diagnoses determined in course of medical examinations and during individual and small-group consultations (see the detailed description of the Screening Program above) were included in our database.

Statistical Analysis

Quantitative analyses were performed using IBM SPSS Statistics 20.0 software package (IBM, Armonk, NY, USA).

Table 2. Diagnoses of regulation disorders in medical examinations and differences between maternal answers in questionnaires.

| | Not diagnosed n; Mean (SD) | Diagnosed n; Mean (SD) | z-statistics in Mann-Whitney tests |
|---|-------------------------------|---------------------------|---------------------------------------|
| Medical diagnoses: Excessive crying, restlessness | | | |
| How can you characterize your child by strong prolonged crying when he/she was a little baby? (5-point Likert scale) | n=507 2.16 (1.10) | n=92 2.90 (1.28) | z=-5.205; p<0.001 |
| According to your observations, how much was your child crying or how fussy was your child in the previous two weeks? | n=486 2.83 (1.12) | n=90 3.31 (1.28) | z=-3.227; p=0.001 |
| How could you soothe him/her when he/she was crying? (5-point Likert scale) | n=505 4.32 (0.77) | n=92 3.97 (0.90) | z=-3.641; p<0.001 |
| How much distress does it cause you when your child is crying? (5-point Likert scale) | n=501 3.59 (1.22) | n=91 4.05 (0.95) | z=-3.208; p=0.001 |
| Medical diagnoses: Loss of appetite – normal weight gain | | | |
| Is feeding your child a challenge for you? (5-point Likert scale) | n=534 1.72 (1.03) | n=28 2.39 (1.47) | z=-2.38; p=0.018 |
| Medical diagnoses: No weight gain or weight loss – alimentary | | | |
| Is feeding your child a challenge for you? (5-point Likert scale) | n=534 1.72 (1.03) | n=28 2.39 (1.47) | z=-3.71; p<0.001 |
| Medical diagnoses: Sleep disorders (sleep awakenings, sleep-onset problems) | | | |
| Generally, how many times does your child wake up during the night? | n=543; 1.71 (1.04) | n=19; 2.79 (1.40) | z=-6.618; p<0.001 |
| How much distress does it cause you when your child wakes up? (5- point Likert scale) | n=467; 2.28 (1.26) | n=91; 3.48 (1.29) | z=-7.51 p<0.001 |
| How much distress does it cause you to put your child to sleep? (5-point Likert scale) | n=499; 1.76 (1.00) | n=92; 2.55 (1.32) | z=-5.75; p<0.001 |

Table 6 shows the significant differences between means and standard deviations of answers to questions in parental questionnaire in subgroups where different regulation disorders were diagnosed or not diagnosed.

For the descriptive statistics in this article, we calculated prevalence distributions and for examining associations between regulation problems and other health conditions, we ran cross-tabs (χ^2 -tests) in the cases of diagnoses (yes/no; 1/0 categorical variables) and Mann-Whitney tests in the cases of questionnaire data (Likert-type items, see **Table 2**).

Ethical Approval

The Institutional Ethics Committee of Heim Pál Children's Hospital approved the study (authorization number: 11/04.2010).

Informed Consent

Informed consent was obtained from the parents of all individual participants included in the study.

Results

Regulation Disorders in Medical Examinations and Screening Program

A total of 1133 mothers (**Table 1**) answered the questionnaires. In a subsample, 619 children had also medical examinations. The sex distribution was almost half and half, male and female, in both groups. The children's ages and other sociodemographic factors were almost the same or very similar in each subgroup. In the whole sample, the average age of children was 15.3 ± 10.8 months. The average number of children in the families was 1.7 ± 0.9 . The average age of the mothers was 32 ± 5.1 years, and more than 90% were married. In addition to medical diagnoses, the main early childhood behavior regulation disorders are also categorized in **Table 3**. In the subsample in which medical examinations were conducted, excessive crying and/or restlessness was present in 15.0%, sleep disorders in

Table 3. Frequency of early behavior regulation problems and other frequent medical diagnoses*.

| Diagnostic categories in the medical examinations | Subsample where medical examinations were conducted (n=619) | Not referred to the screening program after medical examinations (n=436) | Referred to the screening program after medical examinations (n=183) |
|--|---|--|--|
| Excessive crying, restlessness | 15.0% | 5.7% | 37.2% |
| Sleeping problems | | | |
| Sleep disorders (sleep awakenings, sleep-onset problems) | 15.2% | 0.7% | 49.7% |
| Snoring | 2.9% | 1.6% | 6.0% |
| Feeding and weight gain problems | | | |
| Breastfeeding difficulty | 10.3% | 4.1% | 25.1% |
| Loss of appetite – normal weight gain | 5.0% | 1.8% | 12.6% |
| No weight gain or weight loss – alimentary | 3.2% | 0.9% | 8.7% |
| No weight gain or weight loss – organic | 6.6% | 8.3% | 2.7% |
| Breathing problems | | | |
| Irregular breathing | 4.5% | 4.8% | 3.8% |
| Affective apnea | 1.9% | 1.6% | 2.7% |
| Breathing stops | 6.6% | 9.2% | 0.5% |
| Indeterminate symptoms of the infant | 10.5% | 12.8% | 4.9% |
| Symptoms of possible neurological conditions | | | |
| Uncertain sickness, bizarre movements | 4.8% | 5.5% | 3.3% |
| Activity or concentration difficulties | 4.4% | 1.4% | 11.5% |
| Pulmonological conditions or recurrent upper airway infections | | | |
| Recurrent upper airway infections | 24.2% | 25.5% | 21.3% |
| Recurrent wheezing | 23.9% | 30.7% | 7.7% |
| Subglottic laryngitis | 9.9% | 11.5% | 6.0% |
| Gastrointestinal complaints | | | |
| Abdominal colic | 12.3% | 8.7% | 20.8% |
| Constipation | 4.0% | 1.6% | 9.8% |

* In n=619 cases, medical examinations were carried out, followed by a deeper screening program for regulation disorders in n=183 cases, while in n=436 cases this was not necessary. Table 2 presents the prevalences of different disease and disorder categories in each subgroup, showing higher prevalences of regulation disorders in the screening subgroup (see bold figures).

15.2%, breastfeeding problems in 10.3%, and collective feeding disorders in 14.8%. The prevalence of constipation was 4.0%, while abdominal colic was present in 12.3%. Medical examinations were followed by a deeper screening program for regulation disorders in 183 cases, while in 436 cases this was not necessary. **Table 3** presents the prevalence of different disease and disorder categories in each subgroup, showing higher prevalence of regulation disorders in the screening subgroup.

Comorbidity Between Different Early Childhood Regulation Disorders

In cases in which excessive crying was present, the comorbidity with sleep disorders was 50% ($\chi^2(1)=106.20$; $P<0.001$); with breastfeeding disorders 22.6% ($\chi^2(1)=17.69$; $P<0.001$); and with loss of appetite 11.8% ($\chi^2(1)=10.70$; $P<0.001$). In those cases in which sleep disorders were present, the comorbidity with

Table 4. Comorbidity between different early childhood regulation problems*.

| COMORBIDITY Diagnostic categories in the medical examinations | In subgroup where excessive crying, restlessness is not present | In subgroup where excessive crying, restlessness is present | Crosstabs (χ^2 -tests) | In subgroup where sleep disorders (sleep awakenings, sleep-onset problems) is not present | In subgroup where sleep disorders (sleep awakenings, sleep-onset problems) is present | Crosstabs (χ^2 -tests) | In subgroup where breast-feeding difficulty is not present | In subgroup where breast-feeding difficulty is present | Crosstabs (χ^2 -tests) |
|---|---|---|--------------------------------|---|---|-------------------------------|--|--|-------------------------------|
| Sleep disorders (sleep awakenings, sleep-onset problems) present in (%) | 8.8% | 50.0% | $\chi^2(1)=106.20$; $p<0.001$ | | | | | | |
| Breastfeeding difficulty present in (%) | 8.2% | 22.6% | $\chi^2(1)=17.69$; $p<0.001$ | 12.4% | 39.1% | $\chi^2(1)=31.60$; $p<0.001$ | | | |
| Loss of appetite – normal weight gain present in (%) | 3.8% | 11.8% | $\chi^2(1)=10.70$; $p=0.001$ | | | | 4.0% | 14.1% | $\chi^2(1)=12.30$; $p<0.001$ |
| No weight gain or weight loss – alimentary present in (%) | | | | | | | 2.3% | 10.9% | $\chi^2(1)=13.56$; $p<0.001$ |

* Crosstabs (χ^2 -tests): $\chi^2(df)$; p ; frequencies of joint regulation disorders. Table 3 shows the prevalence of important regulation disorders in subgroups where a specific disorder is present or not. E.g. If excessive crying is present, sleep disorders are also present in 50% of the cases, but this proportion is only 8.8% in a subgroup where excessive crying is not a significant complaint.

breastfeeding disorders was 39.1% ($\chi^2(1)=31.60$; $P<0.001$). Other data are displayed in **Table 4**.

Comorbidity Between Early Childhood Regulation Disorders and Other Health Conditions

In those cases in which excessive crying was present, the comorbidity with concentration difficulties was 10.8% ($\chi^2(1)=10.71$; $P<0.001$) and with abdominal colic it was 26.9% ($\chi^2(1)=21.67$; $P=0.001$). When sleep disorders or breastfeeding difficulties or organic feeding difficulties were diagnosed, abdominal colic was also present in 21.3% ($\chi^2(1)=8.33$; $P<0.001$), 23.4% ($\chi^2(1)=8.25$; $P=0.004$), and 34.1% ($\chi^2(1)=19.50$; $P<0.001$) of the cases, respectively. Interestingly, pulmonological conditions or recurrent upper airway infections were more frequent in the subgroups in which regulation problems were not a concern. The other relationships are shown in **Table 5**.

Regulation Disorders in the Parental Report

According to the questionnaire answers, 14.7% of the mothers’ reported low self-confidence when interpreting their infant’s signs; it was 22.1% in a subgroup that was referred to the screening program. A total of 15.6% of mothers characterized their children as strong criers (24.4% in a subgroup that was referred to the screening program). A total of 16% of the children had some type of feeding or weight gain disorder (32.6% in the screening subgroup), and 10% awoke 4 or more times during the night (21% in the screening subgroup). The frequency of symptoms of crying, feeding, and sleeping per parent reporting are shown in **Table 6**.

Diagnoses of Regulation Disorders in Medical Examinations and Differences Among Maternal Answers in Questionnaires

According to the z-statistics in Mann-Whitney tests, mothers of children with a diagnosis of excessive crying reported

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Table 5. Comorbidity between early childhood regulation problems and other health conditions*.

| COMORBIDITY | | Activity or | Recurrent | Recurrent | Subglottic | Abdominal | Constipation |
|--|------------------------------|--------------------------------|------------------------------|-------------------------------|------------------------------|-------------------------------|------------------------------|
| Diagnostic categories in the medical examinations | | concentration difficulties (%) | upper airway infections (%) | wheezing (%) | laryngitis (%) | colic (%) | (%) |
| Excessive crying, restlessness ... | ... not present vs present | 3.2 < 10.8 | 26.0 > 14.0 | 27.2 > 5.4 | 11.0 > 3.2 | 9.7 < 26.9 | |
| | Crosstabs (χ^2 -tests) | $\chi^2(1)=10.7$; $p=0.001$ | $\chi^2(1)=6.27$; $p=0.012$ | $\chi^2(1)=20.66$; $p<0.001$ | $\chi^2(1)=5.41$; $p=0.020$ | $\chi^2(1)=21.67$; $p<0.001$ | |
| Sleep disorders (sleep awakenings, sleep-onset problems) ... | ... not present vs present | 3.4 < 9.6 | | 27.4 > 4.3 | 11.2 > 2.1 | 10.7 < 21.3 | 3.2 < 8.5 |
| | Crosstabs (χ^2 -tests) | $\chi^2(1)=7.22$; $p=0.007$ | | $\chi^2(1)=25.53$; $p<0.001$ | $\chi^2(1)=7.45$; $p=0.006$ | $\chi^2(1)=8.33$; $p=0.004$ | $\chi^2(1)=5.72$; $p=0.017$ |
| Breastfeeding difficulty ... | ... not present vs present | 3.6 < 10.9 | | 25.9 > 6.3 | | 11.0 < 23.4 | |
| | Crosstabs (χ^2 -tests) | $\chi^2(1)=7.40$; $p=0.007$ | | $\chi^2(1)=12.24$; $p<0.001$ | | $\chi^2(1)=8.25$; $p=0.004$ | |
| Loss of appetite – normal weight gain ... | ... not present vs present | | 25.0 > 3.2 | | | | |
| | Crosstabs (χ^2 -tests) | | $\chi^2(1)=7.67$; $p=0.006$ | | | | |
| No weight gain or weight loss – alimentary ... | ... not present vs present | 4.0 < 15.0 | | 24.5 > 5.0 | | | |
| | Crosstabs (χ^2 -tests) | $\chi^2(1)=5.61$; $p=0.018$ | | $\chi^2(1)=4.06$; $p=0.044$ | | | |
| No weight gain or weight loss – organic ... | ... not present vs present | | | 25.1 > 7.3 | | 10.7 < 34.1 | |
| | Crosstabs (χ^2 -tests) | | | $\chi^2(1)=6.65$; $p=0.010$ | | $\chi^2(1)=19.50$; $p<0.001$ | |

* Crosstabs (χ^2 -tests): $\chi^2(df)$; P; frequencies of joint diagnoses. Table 4 shows the prevalence of important somatic complaints in subgroups where a specific regulation disorder is present or not. E.g. If excessive crying is present, abdominal colic is also present in 26.9% of the cases, but this proportion is only 9.7% in a subgroup where excessive crying is not a significant complaint.

significantly more problematic crying behavior (long prolonged crying in early infancy: $P<0.001$, crying and fussiness in the last 2 weeks: $P=0.001$, soothability: $P<0.001$, parental distress: $P=0.001$) compared with those without this diagnosis.

Mothers of children with a diagnosis of loss of appetite or weight loss reported significantly more problematic feeding behavior (feeding as a challenge: $P<0.001$) compared with mothers of children who did not have this diagnosis.

Children with a diagnosis of sleep disorders had significantly more problematic sleep behavior reported based on the parental questionnaire (nightwakings, sleep onset, parental distress compared with those who did not have this diagnosis; $P<0.001$ for all differences) using Likert scale in the questionnaire. Detailed results are shown in **Table 2**.

Discussion

Crying is part of the normal development of an infant. It is a form of communication with parents and results from various stimuli, such as hunger, discomfort, or pain. Excessive crying in the early months is a frequent concern. Pediatricians have to understand and adequately manage the problem and offer support to exhausted parents. Excessive crying may interfere with the mother-infant, father-infant, and mother-father interactions and may increase the risk of child abuse [19,20]. Over the last 15 years, other regulatory disorders of early childhood have attracted the increased attention of both researchers and pediatric practitioners [21-23].

Table 6. Frequencies of behavior regulation difficulties and feelings about them reported by mothers in questionnaires.

| Questions and emphasized values | Sample of mothers filled in questionnaires (n=1133) n; % | Subsample where medical examinations were also conducted (n=619) n; % | Subsample referred to the screening program (n=183) n; % | Subsample not referred to the screening program (n=981) n; % |
|--|---|--|---|---|
| How confident are/were you in interpreting your infant's signs? (5-point Likert scale: values 1-3 for low self-confidence) | 1121 14.7% | 595 16.5% | 181 22.1% | 940 13.3% |
| CRYING | | | | |
| How can you characterize your child by strong prolonged crying when he/she was a little baby? (5-point Likert scale: values 4-5) | 1121 15.6% | 599 16.5% | 180 24.4% | 947 13.9% |
| According to your observations, how much was your child crying or how fussy was your child in the previous two weeks? (more than 1 hour) | 1112 9.3% | 576 12.3% | 177 17.5% | 935 7.7% |
| (more than 3 hours) | 4.5% | 8.6% | 5.6% | 3.7% |
| How could you soothe him/her when he/she was crying? (5-point Likert scale: values 1-3 for low self-confidence) | 1118 12.5% | 597 15.6% | 180 20.0% | 938 11.1% |
| How much distress does it cause you when your child is crying? (5-point Likert scale: values 4-5) | 1113 54.5% | 592 61.2% | 176 69.3% | 937 51.7% |
| FEEDING | | | | |
| Does your child have any feeding or weight gain problems? (yes) | 1099 16.0% | 584 18.2% | 175 32.6% | 924 12.9% |
| Is feeding your child a problem for you? (5-point Likert scale: values 4-5) | 1058 9.6% | 562 9.4% | 175 20.0% | 883 7.5% |
| SLEEPING | | | | |
| Generally, how many times does your child wake up during the night? (4 times or more) | 1105 10.0% | 587 11.2% | 176 21% | 929 7.9% |
| How much distress does it cause you when your child wakes up? (5-point Likert scale: values 4-5) | 1033 23.6% | 558 23.0% | 167 34.7% | 866 21.5% |
| How can your child fall asleep? (it's difficult even after a long process of putting down) | 1105 8.9% | 588 9.0% | 177 14.7% | 928 7.8% |
| How much distress does it cause you to put your child to sleep? (5-point Likert scale: values 4-5) | 1115 9.3% | 591 9.0% | 178 14.6% | 937 8.3% |

* n=valid answers to the question; frequency of emphasized values. Table 5 shows the total number of answers (n) to separate questions and the proportions of answers (%) indicating problems.

Sleeping Disorders

In international pediatrician surveys and cross-cultural comparisons, sleeping disorders (night awakenings and sleep-onset difficulties) are one of the most frequent (10-76%) parental concerns [1,2]. In our large sample (N=1133) questionnaire study, 10% of the children had sleeping disorders. In a subsample in which diagnoses were determined based on medical

examinations and consultations, we found an incidence of 15.2% for sleep disorders. This rate was similar to reports from other countries [1,2].

Excessive Crying

The occurrence of excessive crying was 8-30% in previous large-sample studies [3,24,25]. In our questionnaire study, 15% of

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mothers reported intensive crying in the infants. In a subsample in which diagnoses were determined based on medical examinations and consultations, we found an incidence of 15.0% of excessive crying and/or restlessness. Prevalence rates for excessive crying were lower in some European countries, with 1.5% in the Netherlands [2] and 9.2% in Denmark [26], but comparable to the 16.3% reported in Germany [27].

Eating Disorders

Eating disorders are also common in infancy. Prevalence numbers range from 20% to 25% in the normal population [4,28,29] and from 40% to 80% in infants with disabilities. Mild feeding difficulties occur in approximately 30% of children [4]. The prevalence of clinical feeding disorders is 3-10% [5], and the incidence of more severe failure to thrive is about 3-4% [1].

According to our questionnaire results, 16% of the children had feeding disorders. In a subsample in which diagnoses were determined based on medical examinations and consultations, we found an incidence of 10.3% for breastfeeding disorders and 14.8% for different feeding disorders.

Sleep and feeding disorders are the leading concerns in clinical samples. In a large sample (N=701) in one of the most renowned European clinical programs, the Munich Program [30], occurrence of problems for children were the following: sleep disorders (62.8%), feeding disorders (40.4%), chronic restlessness-motor activity-lack of interest in play (30.1%), excessive crying (29.4%), dysfunctional sleep-wake organization (25.8%), excessive defiance (20.3%), excessive clinging-separation anxiety-social withdrawal (12.3%), and aggression-oppositional behavior (6.8%).

Multiple Regulatory Disorders

Behavioral disorders in infancy can affect an infant's development [21,22,31,32]. Furthermore, infants with behavioral disorders are more likely to have impaired parent-infant relationships [23,33,34].

Approximately 20% of all infants show symptoms of excessive crying, sleeping, or feeding disorders in the first year of life [31]. The prevalence of colic in infants is about 20%, but it depends on parental perception of crying [35]. In our study, the prevalence was 12.3%. In a systematic review and meta-analysis, colic prevalence at 5-6 weeks of age (25.1%) was significantly higher than colic prevalence at 8-9 weeks of age (10.8%) [36]. Most maternal and child health nurses were unaware of the evidence that crying is not associated with gastro-esophageal reflux, but most of them reported that reflux causes pain [37].

Further, a small minority of children (1-2%) will manifest all 3, leading to multiple regulatory disorders [27,38]. Infants with multiple moderate-to-severe regulatory problems experience >10 times the odds of clinically significant mental health concerns during childhood, and these symptoms appear to worsen over time [39].

Comorbidity

Little is known about the association between excessive crying and sleeping or eating disorders in population samples [40]. We found comorbidity among different regulation disorders. Where one type of behavior regulation disorder was present, another type of regulation disorder was more frequently diagnosed (Table 4). Crosstabs (χ^2 tests) have proved ($P<0.05$) that infants who were referred to the screening program because of medical considerations had more frequent behavior regulation disorders than other infants in our study. This, in turn, indicates that the differential diagnostic process was successful in our program.

Wolke et al [41] found that 32.7% of parents reported that their infant had a crying, sleeping, or feeding disorder, and a further 14.6% reported their infant as having more than one of these disorders. Specifically, comorbidity was most likely to occur between crying and sleep disorders. Multiple regulatory problems may identify infants with a high burden of comorbidity that extends into childhood [39,42].

In a retrospective study by von Kries et al [27], a higher prevalence of sleep and eating disorders was found in children up to 4 years of age who were reported to have had excessive crying beyond the sixth month. In our study, the connection between sleep disorders and excessive crying was 50%, but some studies have not found a relationship between excessive crying and sleep disorders and other indicators of multiple regulatory disorders [43], while other studies have found either sleeping or other regulatory disorders [41,44].

The few children with excessive crying and either severe sleeping or eating disorders might constitute a group of infants with multiple regulatory disorders outside the continuous spectrum of normal behavior [40].

Moreover, there is growing evidence of the negative implications for infants whose excessive, persistent crying is present with other regulatory disorders, such as feeding and sleeping disorders [41,45].

A meta-analysis of 22 longitudinal studies showed evidence associating excessive crying and other regulatory disorders (sleeping and eating) in the first months of life with adaptive problems at school age, mainly related to attention deficit-hyperactivity

disorder symptoms and associated behaviors [31,32,46,47]. In our study, the comorbidity between excessive crying and concentration difficulties was 10.8%.

There was no connection between regulation and breathing disorders. Breathing stops and sleep disorders were successfully differentiated. Among those diagnosed with sleep disorders, there were fewer infants who had breathing stops than among the others. Also, there was no relationship with symptoms of possible neurological conditions and uncertain sickness or abnormal movements.

Infants who had early activity or concentration disorders were significantly more highly represented among those who had behavior regulation disorders as well. The occurrence of abdominal colic and constipation, symptoms that are often found to have a psychosomatic background, also correlated with the occurrence of other regulation disorders. The occurrence of diagnoses of excessive crying, sleep disorders, and breastfeeding and other feeding disorders was significantly lower in children in whom recurrent upper airway infections, recurrent wheezing, or laryngitis were diagnosed (Table 5).

Questions about both parental observations and subjective feelings were asked in questionnaires. Some important extreme values of questions are presented for the whole sample, for the subsample in which medical examinations were also conducted, and for the subsample that was referred to the screening program. Mothers of infants who were referred to the screening program because of medical considerations reported more problems in the questionnaires than other mothers in our study (Table 6).

The mothers of the infants with diagnoses of excessive crying, sleep, or feeding disorders reported significantly more problematic behavior in questionnaires as well (Table 2).

Our screening program included children who showed signs of regulation disorders and who were referred for a detailed diagnostic evaluation. The incidence of diagnoses in this program was the following: sleep disorders (49.7%), excessive crying (37.2%), and functional feeding disorders (no organic background; 21.3%).

In order to offer appropriate medical support, the differential diagnostic process is important in separating acute secondary symptoms (e.g., crying, mild and transient sleep and feeding disorders because of general discomfort, nonspecific complaints, pain) of frequent child illnesses (eg, respiratory diseases) from comorbid chronic behavior regulation disorders. In our study, we investigated the relationship between regulation disorders and other health conditions from medical records for which a screening model enabled careful and thorough differential diagnostics.

Outpatient treatment is sufficient for crying or sleeping disorders in infancy. However, hospitalization may be required for feeding disorders because not all feeding disorders can be treated on an outpatient basis [48].

In a study conducted by Schmid and Wolke [46], excessive infant crying (10.1%) was specifically associated with maternal anxiety disorders, especially in infants of younger and less educated first-time mothers. Feeding disorders (36.4%) were predicted by maternal anxiety (and comorbid depressive) disorders in primiparous mothers and infants with lower birth weight. Infant sleeping disorders (12.2%) were related to maternal depressive (and comorbid anxiety) disorders irrespective of maternal parity [49-52].

In our experience, designating risk groups in pediatric care is a complex problem. On the one hand, many parents may report regulation disorders, while based on a strict diagnostic system, a clinical disorder cannot be determined. On the other hand, we can assume that there are many hidden cases in which infants could have a clinically relevant regulation disorder but their parents do not interpret these behaviors as being problematic and do not report them to pediatricians or health care nurses. Thus, we can assume that some cases could remain hidden, while in others, study is requested without a clinical basis. In the latter circumstance attention from a therapeutic perspective is still necessary because of the parents' concern. Questions about the parents' feelings about the specific problems can contribute to a better understanding of the actual situation.

Limitations

Most of the data in the current study were collected via maternal reports. These are often limited by social desirability and reporter bias. Another limitation of this study was our lack of access to father-child interactions. Thus, future research should include both mothers and fathers. Another limitation there was no ethnic diversity, with only white participants in the study. It is important to note that our study used only a short period of data collection. Finally, our sample is not representative; the results can be regarded as estimations for recognizing early childhood regulation disorders in pediatric care.

Conclusions

The For Healthy Offspring Project was the first study to examine the prevalence and the complex (medical and psychosocial) background of the classic behavior regulation disorders (excessive crying, feeding, and sleep problems) in infancy and toddlerhood in Hungary. In this article, the relationship between regulation disorders and other health conditions were

investigated. Crying and sleep and feeding disorders are challenging for most parents, but only a small fraction of these cases can be categorized as clinical disorders. Although our study is not representative, according to our findings, we can hypothesize that the general incidence of early childhood regulation disorders in international research of 5-15% is likely similar to that found in Hungary as well. This study added more information about the associations between regulation problems and other health conditions. Our model for screening enabled the careful differential diagnostic process of separating acute secondary symptoms from comorbid chronic behavior regulation disorders. We highlighted that no other data are currently available on the frequency and types of early childhood regulation problems in Hungary. In order to effectively recognize early behavior regulation disorders in daily practice, diagnostic instruments widely used in international field should be adapted in general Hungarian pediatric care.

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