



Prevalence of Functional Gastrointestinal Disorders in Children and Adolescents

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Objectives To determine the prevalence of functional gastrointestinal (GI) disorders (FGIDs) in children and adolescents in a representative community sample of the US.

Study design The study recruited a general population sample of mothers ($n = 949$) of children and adolescents aged 4-18 years. Child and adolescent GI symptoms were assessed using parental report through online questionnaires, including the Questionnaire on Pediatric Gastrointestinal Symptoms and the PedsQL4.0 Generic Core Scale. Parental GI symptoms, and demographic characteristics were also assessed. The data was used to determine prevalence of FGIDs.

Results Using Rome III criteria by parental report, 23.1% of children and adolescents qualified for at least 1 FGID. Functional constipation and abdominal migraine were the most common FGIDs. All 10 child/adolescent FGIDs occurred, except rumination. Significant prevalence differences were not found between sexes, except in functional constipation, which was more prevalent in males than females ($P = .022$). There were no significant prevalence differences between racial or ethnic groups. Children who met criteria for an FGID had lower quality of life (median = 76.4) than children who did not (median = 89.6; $P < .001$). Children were more likely to qualify for a FGID if their parent also qualified for a FGID ($P < .01$).

Conclusions FGIDs are common in children and adolescents in the US. There are no significant differences in FGIDs between sex, race, or ethnic groups, except in functional constipation. There is overlap between parental and child FGID symptoms. Children with a FGID report a lower quality of life than healthy children. (*J Pediatr* 2016;177:39-43).

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Functional gastrointestinal (GI) disorders (FGIDs) are common disorders characterized by recurring GI symptoms that cannot be attributed to structural or biochemical abnormalities. The Rome III diagnostic criteria for pediatric FGIDs distinguish 10 FGIDs. The prevalence by Rome criteria of these FGIDs has been addressed in multiple studies, and overall prevalence ranges between 12% and 29% for all FGIDs combined. Most studies have used school samples, including the US,^{1,2} Germany,³ Panama,⁴ Ecuador,⁵ El Salvador,⁶ Colombia,⁷ Nigeria,⁸ Sri Lanka,^{9,10} and Japan.¹¹ All these studies reported prevalence in limited geographical areas (eg, Chicago for one of the US studies⁸), limited age ranges (eg, adolescents in Japan¹¹), and many focused exclusively on abdominal pain related disorders (eg, study in Germany,³ Sri Lanka⁹). There is still largely a lack of knowledge on less prevalent FGIDs like rumination.

There is a need for a large-scale prevalence study of all FGIDs in US children. Information including wider geographic areas and minority populations is necessary to describe the overall US population more thoroughly. Furthermore, inclusion of all child ages is important, as FGID prevalence has not been well described in younger age groups. More prevalence information will increase understanding of health issues and may provide guidance for management. For example, it may indicate the need to screen for and treat possibly underrecognized FGIDs. The current study attempted to provide a comprehensive picture of the prevalence of all FGIDs in children ages 4-18 years in a representative community sample of the US.

Methods

This study used a nationwide Internet survey in order to examine the prevalence of functional GI symptoms in children between ages 0-18 years.

FGID	Functional GI disorder
GI	Gastrointestinal
IBS	Irritable bowel syndrome

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The subjects were mothers of children ages 0-18 years old, who were recruited from all 50 states in the US, plus Washington DC and Puerto Rico. Cint USA, Inc (Lawrenceville, New Jersey; www.cint.com) provided the subjects from a pool of individuals who joined online panels to answer a variety of surveys (such as marketing, opinion polls, etc). Cint USA, Inc runs large panels of adults who have signed up to participate in a variety of research. Cint USA, Inc randomly sends e-mails to panel members and panel members decide if they would like to participate. Equal sex composition, age group distribution (infants, toddlers, children, adolescents), and racial/ethnic groups were recruited using quota-based sampling. We focus only on parents of children ages 4-18 years old. The data on infants can be found in a previous report.¹²

The study used mothers as subjects to provide a report about their child's symptoms attributable to the following considerations: (1) mothers are most commonly the primary individual in a household to communicate a child's symptoms to a physician; (2) mothers are more frequently than fathers the primary caregivers, and, therefore, more likely to have better awareness of a child's symptoms; and (3) other studies that have studied the overlap between parent and child symptoms have focused on mothers.¹³⁻¹⁵ We were not able to obtain data from the children themselves because of the nature of the recruitment methods.

Mothers were invited to complete a survey on "child health." The survey was not described as an investigation of GI symptoms to avoid selection bias. Parents read an online consent form and electronically accepted study enrollment. The parents were not asked any identifying information, and the survey was completely anonymous. Each mother completed a secure online survey conducted through Qualtrics software (Qualtrics, Washington, DC).

Each mother answered the entire survey about 1 child. The instructions asked mothers who had more than 1 child to answer all questions about the child whose name was first in alphabetical order. This study was approved by the Institutional Review Board of the University of North Carolina at Chapel Hill.

Rome Questionnaires

The Questionnaire on Pediatric Gastrointestinal Symptoms-Rome III Version is a validated questionnaire for child and adolescent FGIDs.¹⁶⁻¹⁸ The Parent-Report Form for children 4 years of age and older was used.

Mothers also completed a questionnaire about their own symptoms, using the Functional Bowel Module of the Rome III Questionnaire for Adults.¹⁹ Only the questions relating to irritable bowel syndrome (IBS), functional dyspepsia, functional constipation, and functional diarrhea were included (to limit participant burden).

Quality of Life Questionnaire

The PedsQL4.0 Generic Core Scale is a validated scale to measure quality of life in children ages 2 years and up.²⁰ Separate parent-proxy scales were used for toddlers (ages 2-4 years),

young children (ages 5-7 years), older children (ages 8-12 years), and teens (ages 13-18 years). The questionnaire includes separate subscales for physical, emotional, social, and school/daycare functioning and calculates a total score.²⁰ Scores were transformed to a scale from 0-100, with higher scores indicating better quality of life.

Demographics and Health

Demographic questions included age, sex, and race/ethnicity of mother and child. It also included questions about marital status, common health problems, use of common medications, number of doctor's visits in the past 6 months, number of school/work absences in the past 6 months, household income, and state of residence.

Analyses

Inconsistent reporting and multiple entries were identified and excluded. Electronic cookies (small packets of computer code from the survey website placed on the respondent's computer) were used to ensure only 1 response from each computer device and to enable respondents to return to finish the survey within 24 hours if they left it incomplete. Respondents who provided inconsistent responses on 3 Rome questions that were repeated as a quality check, and respondents who showed other indiscriminate responding, were eliminated from the data set (eg, checking the same answer for a large number of variables, responses that were incompatible with each other such as inconsistent reporting of child age, etc.). Mothers who lived with their child less than one-half of the time were excluded because of increased likelihood of incomplete information. Mothers of children with inflammatory bowel disease or cancer were also excluded. There were no missing data because the Qualtrics survey required completion of every question.

Descriptive analyses were conducted to determine means and SDs as percentages of the sample. χ^2 tests compared differences between subgroups for categorical variables, and t tests compared continuous variables.

Results

The study included 1447 mothers of children aged 0-18 years old. Of these, 1127 subjects provided information about children ages 4-18 years, and 949 (84.2%) of the responses about children aged 4-18 years were judged valid (provided consistent survey answers on quality/validity checks). **Table I** contains the general demographics and characteristics of the sample.

Mothers reported on the following existing physician-diagnosed GI disorders in their children: constipation (1 participant—remained in study), dyspepsia (1 participant—remained in study), lactose intolerance (1 participant—remained in study, but did not qualify for any of the Rome diagnoses), fructose intolerance (no participants), celiac disease (no participants), chronic diarrhea (no participants), IBS/FAP (no participants), and gastroesophageal reflux disease/heartburn

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