Multiple chemical sensitivities (MCS) syndrome, also known as idiopathic environmental intolerance, is a controversial diagnosis that encompasses a wide range of waxing and waning, subjective symptoms referable to more than one body system and provoked by exposure to low levels of chemicals, foods, or other agents in the environment. Although MCS has been studied extensively, a unifying mechanism explaining the illness remains obscure, and clinicians are divided as to whether such a medical entity exists separately from psychosomatic syndromes. MCS is an adult diagnosis; there is little reference to pediatric cases in the scientific literature. In this case from the Pediatric Environmental Health Subspecialty Unit at Boston’s Children’s Hospital, I present the case of a preschool child who had suffered from milk allergy and poor weight gain as an infant, and then later developed asthma, allergic symptoms, sinusitis, headaches, fatigue, and rashes precipitated by an expanding variety of chemicals, foods, and allergens. I review definitions, mechanisms, diagnostic strategies, and management, and discuss some uniquely pediatric features of MCS as illustrated by this case. Key words: idiopathic environmental intolerance, multiple chemical sensitivities. Environ Health Perspect 108:1219-1223 (2000). [Online 20 November 2000] http://ehpnet1.nih.gov/docs/2000/108p1219-1223woolf/abstract.html

Case
A young girl (4 years 11 months of age) was referred to the Pediatric Environmental Health Subspecialty Unit at Boston’s Children’s Hospital (PEHSU) for evaluation. She had been previously diagnosed by her pediatrician as having allergies, frequent otitis media, congestion, sinusitis, and reactive airway disease, with cough-equivalent bronchospasm especially prominent during upper respiratory infections and exercise. During infancy the patient had been diagnosed with poor weight gain due to a milk allergy and treated with an elemental milk and then soy formula. There was a family history of atopy; the father and secondary relatives had childhood asthma and hay fever. Previous allergy testing was positive only for cat dander; therapy included inhaled bronchodilators, steroids, antihistamines, and cromolyn.

At home, the family allowed no tobacco smoking and had reordered the house to make it more habitable for the patient. They had removed all carpeting and covered the mattresses on the child’s bed. The house was frequently dusted and the gas-fired furnace and ductwork were regularly cleaned.

The patient’s mother was concerned that her daughter’s symptoms were becoming worse with a variety of environmental triggers and an expanding list of symptoms. Volatile organic chemicals, cleaning compounds, detergents, perfumes, cigarette smoke, dust, and paints caused new symptoms of pruritis, headache, fatigue, nausea, difficulty breathing, and malaise. The patient was on a restricted and rotating diet, which included goat cheese and duck eggs, because of her food allergies to citrus, seafood, foods containing preservatives, and meats. The parents had purchased only all-cotton clothing for the patient because polyesters and other artificial fibers made her itch and reportedly caused rashes. The parents had also sought help from a naturopath, who had also found multiple allergies. The patient was regularly given certain herbal preparations, including echinacea, astragalus, pulsatilla, bryonia, forssolin, and quercetin, with some relief of symptoms, according to the parents.

The child frequently had olfactory warning when chemicals in the environment were going to exacerbate her symptoms; whenever she voiced her anxieties, the family then quickly left the environment. Thus the patient had begun to severely limit her activities because of her multiple chemical sensitivities (MCS). For example, the mother no longer took her daughter into public restrooms or grocery stores because the disinfectants caused dizziness, fatigue, headache, chest tightness, and nausea. After the patient visited the PEHSU, her mother complained that some areas of the hospital had been freshly painted and that the patient had later become symptomatic with an asthma attack. She feared that the patient’s imminent transition into public school kindergarten would likely be sabotaged by the school’s routine use of pesticides and cleaning products. The school had supplied her in advance with material safety data sheets covering 15 commercial products, which contained more than 35 chemicals applied indoors during the routine maintenance at the school. School officials denied that any renovations were planned, but they promised to work with the parents to limit the patient’s contact with chemical exposures.

A physical examination revealed a frail-looking child with no evidence of rashes or eczema. The eye, nose, and throat exam showed mild nasal turbinate swelling and redness, but no involvement of the conjunctiva or throat. The patient’s lungs were clear, and the heart and abdomen, as well as the rest of the exam, were within normal limits. Previous blood work, including peripheral eosinophil count and serum IgE level, was negative or normal.

The family was counseled about keeping a home symptom diary. Pulmonary function testing was recommended when the patient became old enough to cooperate. Coping measures and feedback to empower the patient were discussed. Anticipatory guidance was given on working with school officials to limit the environmental impact on the patient’s school attendance. Follow-up 9 months later revealed continued respiratory and other symptoms with limited effectiveness of avoidance strategies, environmental controls, herbs, and medications. The patient had missed 15 days of her half-day kindergarten due to her symptoms, which seemed to be worsened by the school’s use of a new carpet-cleaning solution.

Address correspondence to A. Woolf, Regional Center for Poison Control & Prevention, IC Smith Building, Children’s Hospital, 300 Longwood Avenue, Boston, Massachusetts 02115 USA. Telephone: (617) 355-5167. Fax: (617) 738-0032. E-mail:woolf@ai.tch.harvard.edu

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A controversial syndrome in adults known as MCS is characterized by a range of disparate symptoms involving the skin, vascular, genitourinary, musculoskeletal, gastrointestinal, pulmonary, and central nervous systems, which are “triggered” by low-dose exposures to chemicals, foods, biologicals, or other toxic agents in the environment. Often adult MCS syndrome is initially precipitated by an exposure to a chemical in the workplace; subsequently the patient develops more and more intolerance to an array of foods, chemicals, and other “incitants” until he or she is functionally disabled. However, many clinicians question the validity of MCS as a medical entity and include it among “fashionable diagnoses” such as chronic fatigue syndrome or fibromyalgia, representing smogmatization of essentially psychiatric complaints (1). Clinicians, researchers, and health policy makers cannot even agree on the name of this entity. MCS is also known as idiopathic environmental intolerance, environmental illness, environmental hypersensitivity, and universal reactors. MCS as a construct is felt by some to overlap with sick building syndrome (2,3) or the Gulf War syndrome (4-5).

MCS was recently reviewed by Kipen and Fiedler (6). Yet children, as the case presented here, whose illnesses resemble the adult syndrome of MCS have been referred to our PEHSU. The American Academy of Pediatrics includes MCS in its recently published Handbook of Pediatric Environmental Health, but offers no diagnostic criteria (7). Indeed it suggests that such diverse childhood maladies as attention deficits, learning disorders, sick building syndrome, and hyperactivity syndromes can share elements with and overlap MCS.

Pediatric case definition. The case described in this paper meets certain definitional characteristics of MCS, such as a) effects on more than one body system; b) the occurrence of a variety of chemical, food, and biologic agent triggers at low-level concentrations; c) spreading of the incitant agents responsible for symptoms; d) progressive involvement of body systems; and e) the lack of a diagnostic or an abnormal laboratory assay. Although this child had been previously diagnosed with milk intolerance, asthma, and sinusitis, no one unifying set of diagnoses or explanations seemed to satisfy her range of symptoms or the progressive nature of her sensitivities. As the case with this child, many adults with MCS report the spreading nature of their intolerance to low-level environmental toxic agents—more and more toxicants must be avoided as time goes on. Diverse precipitants of symptoms have been postulated: biological agents, electromagnetic radiation, off-gassing construction materials and home decorations, foods, pesticides, synthetics, perfumes, other toiletries, and the like are cited as common offenders.

The diagnosis of MCS in children differs from that in adults in some significant ways. For example, many adults with MCS cite a workplace chemical exposure as the precipitant of the disease, and the illness has been addressed as an occupational health issue (8-12). For children, the incitant is more likely to be found in the home or school. Many symptoms in adults are subjective and often include fatigue, malaise, headache, dizziness, burning sensations, breathlessness, a “mental fog” of impaired cognition, and paresthesias; no objective laboratory abnormalities characterize the disorder. In the case presented here, the parents largely provided the history (and the interpretation) of the child’s symptoms, complaints, and reactions. Youn children are often not able to pinpoint or articulate their own symptoms well. They cannot recall the time course of their own symptoms or associated findings, and clinicians must rely on parents to recount their observations of their child’s health. Because there is no single objective test finding to confirm the diagnosis of MCS, its diagnosis in children will often rest largely on historical information obtained from the parents.

MCS definitional criteria have been previously devised for adults (13); these are summarized in Table 1, but modified to be more applicable to pediatric cases. The progressive nature of symptoms titered to smaller and smaller doses of precipitants (triggers, allergens, incitants), the olfactory warning of offending odors, and the progressive restrictions upon the patient’s activities and habitable environments all characterize the unfortunate victims of this condition, although there is no unifying theme that covers the spectrum of MCS syndrome.

Table 1. Clinical diagnostic criteria of MCS syndrome in children.

| Nature of incitants provoking a response |
|-----------------------------------------|
| Responses to offending environmental toxics occur at levels of exposure below the 2.5 percentile for response in the general population |
| Child responds to multiple substances that are unrelated chemically (i.e., causes lack specificity). The symptoms are not confined to one or several environments (e.g., only sick buildings) |

| Biologic plausibility, identifiable exposure |
|---------------------------------------------|
| Symptoms are reproducible with exposure with reasonable consistency |
| Symptoms resolve after removal of incitant exposures |
| An identifiable exposure preceded the onset of the problem |

| Topology of responses |
|-----------------------|
| Adverse responses affect more than one bodily system |
| Primary complaints include neuro-psychologic symptoms |
| The child exhibits altered sensitivity to odor |
| Persisting nature of perceived changes |
| The disorder is chronic |

| Differential diagnosis |
|------------------------|
| No single, accepted test of physiologic function correlates with the symptoms |
| Subjective responses and ameliorative actions of affected children |
| The caretakers and/or child perceive the child’s response as unpleasant or disturbing |
| The family has sought professional advice |
| The individual’s caretakers believe he or she has a disorder |
| The family takes action to avoid exposures to symptom-inducing chemicals |

Modified from Nethercott et al. (13).
detailed physical examination. Testing of hair, blood, urine, or other tissues as a screening measure for excessive environmental toxins is generally not helpful. The assessment must be directed toward the exclusion of other diagnoses, such as asthma, simple migraine, allergies, or an immune disorder.

Radioallergosorbent tests, serum IgE concentrations, and skin testing for common allergens may be helpful diagnostic procedures in children to confirm a diagnosis of atopy or allergies. Pulmonary function testing may reveal airway obstruction in cases of childhood asthma.

Alternative practitioners who call themselves "environmental practitioners" or "clinical ecologists" claim that provocation-neutralization challenges by sublingual or dermal application or parenteral injection of the identified toxicants can diagnose or confirm asthma. Some children to confirm a diagnosis of atopy or allergies. Pulmonary function testing may reveal airway obstruction in cases of childhood asthma.

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enzymes necessary for chemical detoxification; they prescribe dietary supplements, oxygen, antioxidants, or vitamins to repair such unproven deficiencies. Clearly allergic symptoms may respond to desensitization, bronchodilators, and other allergy medications; however, medications are rarely used as treatments by alternative practitioners.

As outlined in Table 2, some therapies used to treat MCS hold special risks for children, and their use should be discouraged. Herbal products used to treat MCS hold special risks for children, and their use should be discouraged. Bronchodilators, and other allergy medications such as repeated catharsis, beta blocks, or “sweat therapies,” advocated by some practitioners when there is no scientific evidence that these are effective strategies for the treatment of MCS. Infants and young children are generally more susceptible than adults to cathartics (41) and dehydration and electrolyte abnormalities by virtue of their small size, restricted access to replacement fluids, and immature renal concentrating system (42).

Psychologic approaches and coping strategies. Newer biopsychologic modalities of management, including biofeedback, electrophysiologic monitoring, coping strategies, family-centered therapy, and behavioral modification (psychologic desensitization) techniques, are worth investigating in children (43). Breaking through the mistrust of families and their hostility to allopathic medicine is important; MCS-affected children and their parents must be accorded the same compassion and respect given to all other groups of patients (7). School systems, social services, and other community-based agencies should offer to work with families in helping to cope with the illness.

Future studies. The Council on Scientific Affairs of the American Medical Association, the American College of Physicians, the American College of Occupational and Environmental Medicine, and other professional groups have all issued position papers that are openly skeptical of MCS as a distinct medical entity (15,24,44). They call for more scientific research into the tenets of clinical ecology and MCS in order to subject the numerous theories concerning this disorder to the peer review of evidence-based, controlled investigation. Research is made more difficult because of the lack of objective findings; some patients claim that their chemical sensitivities may shift from one chemical agent to another without warning. The olfactory warning invoked by MCS suffers makes the design of double-blinded studies problematic. Whatever the difficulties, such scientific investigations should also be extended to children whose complaints resemble those of adults suffering from MCS syndrome so that better solutions can be offered to those children and their families disabled by this disorder.

### Table 2. Pediatric considerations in multiple chemical sensitivities.

| Diagnosis |
| --- |
| There is no agreed upon case definition of MCS in adults and little that is evidence-based in the diagnosis or treatment of adults. There is even less known about children so diagnosed. It has been proposed that children’s learning disorders or attentional deficit hyperactivity disorder (ADHD) might be explained by MCS, but without any convincing scientific evidence. Adults with MCS have often been diagnosed with psychiatric conditions such as anxiety neurosis, somatiform syndromes, or depression. It is unknown whether affected children or their parents or caretakers have specific psychologic diagnoses. However, it seems clear that they are living with considerable psychosocial stress and pain. | |

| Management |
| --- |
| Parents will frequently shop for a doctor and seek alternative practitioners because of their frustrations and dissatisfaction with the response of physicians to their child’s MCS. It may be difficult for health care providers to communicate with parents who hold such a system of fixed beliefs about their child’s illness and perceived environmental toxicities. Therapies recommended by clinical ecologists may engender additional risks if used for children. For example, severely restricted diets can interfere with the basic nutritional requirements needed for normal growth and development. Other therapies recommended, such as desensitization, herbs, or vitamins, may be especially harmful to children, whose developing body systems (e.g., central nervous and immune systems) are particularly vulnerable to injury. Young children may have a limited capacity to detoxify certain herbs, hormones, and remedies through the liver and kidneys, with a consequent higher risk of toxic reactions. Infants and young children are particularly vulnerable to fluid and electrolyte imbalances provoked by laxatives or purging; they may not have the capacity to detoxify and eliminate herbs, minerals, and dietary supplements used by clinical ecologists and other practitioners as remedies in adults. | |

| Public health and psychosocial issues |
| --- |
| Many adult MCS patients implicate an incident in the workplace that involved a chemical exposure as the inciting agent. For children, school or home would logically be the commonly implicated site of the triggering exposure to a food, drug, or chemical. The social isolation that accompanies chemical avoidance strategies is particularly disabling for children. Such isolation impairs a child’s ability to make friends and otherwise interferes with normal psychosocial development. Avoidance of school may impair their intellectual development. Children as well as adults are entitled to the same protections afforded by federal laws under the Americans with Disabilities Act (34). This federal law has been applied to include patients with MCS. For children, the law could be interpreted to include special accommodations if pesticide spraying or other chemical applications were planned at a school or day care center. The law might mandate other accommodation of the special needs of a child with MCS. Children depend on adults to make responsible choices concerning their health that are in their best interests. The diagnosis of MCS can lead to lifestyle choices that may add stress to family relationships, especially if parents disagree between themselves or with health care professionals on the diagnosis and management options open to them. | |

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41. The Environmental Health Information Service (EHIS) offers online, searchable access to:
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   • National Toxicology Program Technical and Toxicity Reports
   • Report on Carcinogens
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