Examining the Health and Drug Exposures among Canadian Children Residing in Drug-Producing Homes

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Objective To examine the health and well-being of children residing in residences where drug production is occurring.

Study design Starting in January 2006, children identified by police and the Children's Aids Society in the York region of Ontario, Canada, were referred to the Motherisk Program at the Hospital for Sick Children for pediatric assessment of their general health and well-being, with specific focus on illicit-drug exposure. We used a standard protocol to collect all available medical and environmental history, conducted physical and neurologic examinations, and collected hair for analysis of illicit drugs.

Results In total, 75 children, at the mean age of 6.5 years, were referred to us after being removed from homes where marijuana was grown (80%) or other operations linked to drug production were occurring (20%). Overall, rates of health issues in this cohort fell below reference values for Canadian children. Of the hair tests, 32% were positive for illicit substances. In the majority there were no clinical symptoms related to these drugs.

Conclusion The majority of children removed from drug-producing homes were healthy and drug free. Comprehensive evaluations should be performed on a case-by-case basis in order to determine what is ultimately in the best interest of the child. *(J Pediatr 2011;159:766-70)*.

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Production of illicit substances in residential homes poses public health concerns.[1] In Ontario, as many as 15 000 illegal drug-producing homes existed in 2002, a 250% increase from 2000 estimates.[2] In 2004, approximately 60 clandestine synthetic drug laboratories were seized in Canada.[3]

Children may be present in homes where illegal drug operations occur because their families are involved in the operation or because they act as "crop sitters" to conceal it by adding a thread of legitimacy to the residence. With an estimated 10 000 children residing in such homes between 2000 and 2003 in Ontario,[2] police and the Children's Aid Society have been concerned about the associated risks for these children. In 2006, the Motherisk clinic at the Hospital for Sick Children was asked by police and the Children's Aid Society to develop a program to follow these children and to assess their health and well-being, with a focus on the risks to children in drug-producing homes of environmental exposure to drugs.

The risks associated with a clandestine methamphetamine laboratory differ greatly from those associated with an illegal drug-producing home where the child is exposed primarily to plants.[4] These compounds are produced by using a variety of industrial and pharmaceutical chemicals, often in make-shift "laboratories." Risks associated with these types of facilities include the potential for explosions and for contact with or ingestion of irritating and caustic chemicals (and drugs), a serious toxicologic threat.[5,6]

In contrast, marijuana-growing operations usually contain, aside from the plants themselves, chemicals such as fertilizers and, more rarely, insecticides. In large quantities, these chemicals might be harmful but pose little risk for explosion or similar, more immediate dangers. These risks may not be significantly different from those affecting children residing in places in which farming or other horticultural activities take place.[7,8] Other risks usually associated with marijuana-growing operations are related to housing modifications, such as illegal electric connections and issues associated with living in a closed, humid environment such as mold overgrowth in the interior walls, which have the potential to cause respiratory and allergy-related illnesses.[2,9]

Hair testing has become a useful tool in substance-abuse monitoring and in determining exposure to environmental contaminants.[10] Hair can offer a chronologic time frame of exposure in addition to being a stable matrix and a specimen that can be sampled noninvasively.[10] Use of hair testing to identify exposure to drugs of abuse is widespread in workplace testing but has also been used to study exposure to drugs present in the environment.[11-13]

MDMA	3,4-Methylenedioxymethamphetamine

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The objective of the present study was to evaluate the cohort of children examined by Motherisk clinicians after having been removed from drug-producing homes in the greater Toronto area and referred for evaluation by child welfare authorities.

Methods

Since January 2006, children from drug-growing homes in the Toronto area identified by police and the Children's Aid Society were referred to the Motherisk Program at the Hospital for Sick Children for assessment of their general health and well-being, with specific focus on exposure to illicit drugs. Upon discovering children in these dwellings, police routinely called the Children's Aid Society, which removed them immediately from their homes and families. We were then asked to examine the children to assess their health and well-being. The Motherisk Program is a counseling and follow-up program for families that focuses on safety and the risk for drug and chemical exposure during pregnancy and lactation. In addition to counseling and follow-up, the program has a large analytic laboratory that measures drugs of abuse and alcohol in hair and meconium.

The children were accompanied to our clinic by child protection workers with or without their parents. A standard protocol was followed in the evaluation of these children (**Appendix**; available at www.jpeds.com); it included demographic details, drug contexts, medical histories, and school histories of the children; child development and neurologic examination; toxicology-related evaluation; in-clinic examinations; and hair analysis for drugs of abuse.

Hair tests for drugs of abuse were conducted by the Motherisk laboratory, employing validated analytic tests that we use routinely.[11-14] Results of the hair tests were not known at the time of the clinical assessments. In adolescents, we also inquired about the possibility of their own use of recreational drugs.

Descriptive statistics were used to characterize the studied cohort. ORs were calculated when appropriate with 95% CI. The study was approved by the Hospital for Sick Children's Research Ethics Board.

Results

The mean age was 6.5 years (range 2 months to 15 years). Among marijuana-growing homes, less than 25% (9/37) had 1 child; the majority being inhabited by families of multiple children (>75%, or 28/37). Of the children who came to the consultation, 26 (34.7%) were accompanied by somebody other than their parents because custody had been taken away from the parents, at least temporarily. Of the children, 45 (60%) were of Asian ethnicity (Chinese or Vietnamese), 28 (37.3%) were Caucasian, and 2 (2.7%) were Hispanic. These numbers are distinctly different from the ethnic makeup of Toronto (>70% Caucasian and <20% Asian). Asian children found in marijuana-growing houses (n = 41) were more likely to come to the consultation accompanied by somebody other than their parents than were the Caucasian children (n = 18) (OR 3.3; 95% CI; 1.04-11.1; $P = .04$).

Home Environment

In total, 75 children (from 46 different homes) were assessed between January 2006 and January 2010. The majority of these homes (39/46, 80%) were marijuana-growing operations or homes where large quantities of marijuana were found. The remaining homes were engaged in cocaine (1/46) or amphetamine (3,4-methylenedioxymethamphetamine [MDMA]) production (2/46) or were homes in which multiple drugs were being produced or stored, including marijuana, cocaine, MDMA, and heroin (2/46). The median number of plants found in marijuana-growing houses for which information was available (n = 38) was 324 (95% CI; 200-350; range 20-675).

One marijuana-growth operation in which 2 children resided contained unspecified weapons. In one methamphetamine lab, explosives and hazardous chemicals were in close proximity to the children's play area. In 4 homes, at least one adult (parent or step-parent) was using or abusing the drugs produced. Finally, for one home, the written report specified "horrendous living conditions," although no further details were provided. The remaining 39 homes were not reported to be associated with any significant structural problems or safety issues.

Health of Assessed Children

Most of the children were in good health at the time of assessment. School-age children attended school at grades appropriate for their ages. In all cases, parents reported anxiety and apprehension in the children after being removed from their families. An array of mostly minor health issues were detected in some children, including respiratory, speech/language, and developmental pathologies (**Table I**). Of those children, 3 (4%) had mild eczema; 3 (4%) had asthma; 1 suffered mild allergies; 3 (4%) had experienced recent respiratory infections, one of whom had pneumonia. Of the children, 5 (6.6%) had developmental issues, including attention deficit disorder, speech impairment, learning problems, and minor autistic tendencies.

Four children were overweight. In the home in which conditions were described as "horrendous," the 2 children were found to be small for their age (weights 10th and below 3rd percentile, heights 25th and 5th percentiles, respectively). All other 69 children (92%) were deemed to be growing at the appropriate rates for their ages.

Fifteen children had incomplete medical histories as the result of the absence of their parents at these assessments, which prevented the obtainment of full pediatric histories and necessitated the reliance on written reports and interviews with child workers and the children themselves.

Toxicology Hair Test Results

Of the 75 children assessed, 72 underwent hair tests and 3 did not have sufficient hair; 24 (33%) tested positive for at least 1 substance, and 4 tested positive for more than 1 (**Table II**). The

Table I. The occurrences of identified health issues in the cohort of assessed children apprehended from drug-producing homes compared with the values found in respective Canadian reference populations

Pathology/illness	Present study	Canadian prevalence	Reference
Dermatologic (eczema)	4%	14.5%-22%	19
Respiratory (asthma and bronchitis)	4%	15%-20% in early years; 13% in late adolescence	20-22
Neurodevelopmental problems (ADHD, speech and learning impairments, autistic tendencies)	6.6%	14.1%-16.2% speech; 21.8% learning impaired	23
Physical development (overweight)	4% overweight; 1.3% obese	17% overweight; 9% obese	24
Premature delivery	4%	6%	25

ADHD, attention deficit hyperactivity disorder.

hair-test results showed that 7 were positive for cocaine (2 of which were also positive for benzoylecgonine, the cocaine metabolite), and concentrations ranged from 2 ng/mg to 23.26 ng/mg. Concentrations in children younger than 12 months of age tended to be higher (median = 7.51 ng/mg; n = 4) than those in older children (median = 2 ng/mg; n = 3). Unfortunately, the limited number of children in each group precluded statistical analysis of this trend. However, this is in line with previous observations that nonambulatory children (ie, those <18 months) who depend on their caregivers more than older children also have significantly higher exposures to drugs present in the environment.[15] Only the toddlers with the highest hair concentrations for cocaine were also positive for benzoylecgonine, suggesting some degree of systemic exposure to cocaine. The remaining 5 children were negative for benzoylecgonine, suggesting external contamination of the hair.

Of the hair samples, 12 were positive for cannabinoids; concentrations ranged from 0.1 to 0.6 ng/mg, and 3 samples were reported as having "trace amounts." Unlike cocaine, there did not seem to be any age-dependent differences in concentrations of cannabinoids in hair (median level for children <8 months, 0.24 ng/mg; n = 2; median level for older children, 0.2 ng/mg; n = 7). Two hair samples were positive for opiates. Finally, 4 hair samples were positive only for methamphetamine and 2 for MDMA. One sample was confirmed positive for both methamphetamine and MDMA.

Stratifying the test results by type of drug produced or found in the homes, children tended to test positive for the substances produced in their homes (Table II). Notably, the 4 children found in the crack-cocaine home did not have positive hair tests for drugs of abuse. The 2 children found to be living in the home storing MDMA that was described as having "horrendous living conditions" had positive hair tests for MDMA at high concentrations. These 2 children exhibited stunted growth. Two other children found in a clandestine methamphetamine laboratory were positive for the drug itself as well as for cocaine (benzoylecgonine, the cocaine metabolite, was absent). Of the 57 children found in the 46 homes where marijuana was the concern, 15 produced a variety of positive test results (26.3% positivity rate): 2 children were positive for cocaine; 10 (17.5%) were positive for cannabinoids; 4 (7%) were positive for opiates; and 1 child (1.75%) was positive for both methamphetamine and MDMA. Children found in homes where multiple drugs were seized tested positive for such drugs accordingly; 6 of 8 children had positive test results for at least 1 substance, a 75% positivity rate: 1 child was positive for 2 drugs (cocaine and cannabinoids); 2 children tested positive for cocaine only; 1 child tested positive for cannabinoids only; and 2 children tested positive for methamphetamine. None of the children displayed signs of acute toxicity related to the drugs found in their hair, but 2 children tested for MDMA exhibited evidence of stunted growth, as described above.

Discussion

Despite our findings that 30% of the children in our study tested positive for drugs of abuse in their hair, we found that the vast majority were in good health at the time of examination, which was within 1 to 2 weeks from their removal from their homes. The rates of the mostly minor health issues observed were well within the range expected in Canada and other developed countries (Table I). The current protocol followed by Police and Children's Aid Societies has been based on the assumption that the grow-houses and the individuals who operate them are not safe for children. It is

Table II. Hair test results for common illicit substances for assessed children, stratified by the drug found in their respective residences

Drug found in home	Children total	Cocaine-positive test	Opiate-positive test	Cannabinoid-positive test	Methamphetamine/MDMA-positive tests
Cocaine	4	0	0	0	0
Marijuana	61	2	2	8	1
Methamphetamine/MDMA	4	2	0	0	4
Multiple drugs	3	1	0	0	2

not clear whether the risk of interrupting a nurturing parent-child relationship has been adequately considered in all cases. There is a growing body of literature concerning the health and developmental outcomes of children of substance-using parents. Although often conflicting in their results, the overall concern is that these children are over-represented in a number of health problems, particularly behavioral and developmental problems and adolescent drug use.[26] Our study suggests that living in drug-producing homes, especially in marijuana grow-houses, cannot be automatically equated with parental use of illicit drugs. Many of the parents probably enjoy lucrative income from these operations and were not necessarily using the drugs produced, which concurs with the favorable outcome in the children. Moreover, none of these families had been under the care of child protection agencies prior to the index event. Two children assessed as being quite small for their ages and found in a clandestine MDMA laboratory in extremely undesirable living conditions were probably subject to child maltreatment and neglect, based on social worker and pediatric evaluations.

The positive drug hair-test results in the children in our study were mostly the result of passive exposure. This is probably best exemplified by the fact that only 2 children of 7 who tested positive for cocaine were also positive for its systemic metabolite, benzoylecgonine. There are a variety of ways by which children's hair may become contaminated by drugs of abuse, thereby testing positive. We have previously reported that younger children who might be handled more or who spend more time in the home environment have higher concentrations of drug in their hair samples when compared with older children.[15]

It is critical to review the consequences of automatic removal from their families of children found in such environments. Child apprehension may inflict fear, neglect, confusion, sadness, and similar adverse effects.[16] Indeed, in many cases, the reports of parents suggested such trauma among our patients. Therefore, removal of children from their parents must be based on solid evidence that the risks of staying with the parents outweigh the risks of separating the child from the core family.

In 2006, the province of Alberta passed the Drug Endangered Child Act,[17] which authorized the state (child welfare authorities or the police) to seize children from drug-producing homes, even if based on suspicion alone.[18] Often these children, and even the parents, might not know about the drugs. More troubling is that there may not even be illicit substances present, but rather the chemicals used to create such substances, and this may be deemed sufficient for apprehension of the children. To add to the equation, the Motherisk Laboratory at the Hospital for Sick Children receives hair samples to be analyzed for drugs of abuse from thousands of parents implicated in child-protection matters each year from across the country, and they are analyzed for drugs of abuse. Based on consultations with child protection workers or the respective authorities, children are rarely removed from drug-using parents' care until substantial evidence of child safety issues is built. Among our cohort of children presented here, however, the majority of the parents were not known to be using illicit substances themselves and, on the basis of our clinical assessments, appear to be able to parent their children adequately. It is not likely that the production of drugs, particularly marijuana, hinders effective parenting much more than actual drug use, yet the differences in the ways these cases are handled suggest that police and child protection agencies perceive the former to be of greater concern with respect to child safety than the latter.

If residential marijuana production is discovered, children and their parents should be removed from the physical location of any such hazards; however, our data suggest that in most cases there is no medical justification to remove them from their parents. Our study documents that only a small proportion of children assessed were likely to be in need of interventions by child-welfare services because of potential risks caused by parents.

Our study has several weaknesses. We assessed children's health and developmental histories partially based on parental reports, which could be biased because they could affect child custody. In some cases the parents were not available and the assessments were based on medical records and interviews and on the assessments of child workers and of the children themselves. Under the urgent clinical situation, we could not conduct neurodevelopmental assessments that could detect more discreet deficits, and in most cases information on abuse and psychological evaluations were not made available to us. This report is not population based and lacks an appropriate contrast group, so it cannot be used to calculate the prevalence of or incidence of this very troubling phenomenon.

The strengths of our study include the direct referral from authorities, which allowed us to examine a relatively large number of children in a systematic manner. Also, the children were evaluated by pediatricians with clinical pharmacology/toxicology backgrounds, and we conducted highly specific toxicologic tests to evaluate toxic exposure. Such tests are commonly missing from environmental toxicologic studies. Our study lays the groundwork for the design of much-needed prospective cohort studies in this population of children. ■

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Appendix

Motherisk Clinic Protocol for Children in Grow Houses and Meth Laboratories

1. Demographics: Name, age, contact, family context; demographic details, including age, height, weight, and BMI and family structure and siblings.
2. Drug context: What was found by police (drugs involved, environment: firearm risk, electricity risk, mold, other).
3. Medical history of child: Interviews with parents, child workers; reviews of all medical charts, routine visits to physician, vaccination history.
4. School history of child: Concordance between chronologic age and education level and evidence of delays.
5. Child development: Interviews with parents, examination of child, review of school reports; achievements as expected from the chronologic age through interviews with parents and children and neurologic examination.
6. Toxicology-related symptoms: Symptoms of CNS stimulants or depressants, stunted growth, aberrant behavior, or developmental delays, addressing both acute and chronic symptoms that occurred while residing in the drug-producing home.
7. In-clinic examination: Full pediatric physical and neurologic examinations.
8. Hair analysis for drugs of abuse: Testing for drugs discovered by police (according to police report); routine test also for cocaine, opiates, and amphetamines (including methamphetamine and MDMA).