

**Environmental Health Risks in Children:**

**Screening Tools for Community Health Nurses and  
Paraprofessional Home Visitors and Their  
Integration within Public Health Practice**

Consultant:

Bonnie Hamilton Bogart, BN, MEd

Prepared for

National Collaborating Centre for Environmental Health

BC Centre for Disease Control

March 31<sup>st</sup>, 2014



National Collaborating Centre  
for Environmental Health

Centre de collaboration nationale  
en santé environnementale



**BC Centre for Disease Control**  
An agency of the Provincial Health Services Authority

## Table of Contents

Acknowledgements.....	iii
Executive Summary.....	1
Purpose .....	3
Background .....	3
Children’s Unique Vulnerability .....	3
The Role of Home Visitors.....	4
Methodology.....	4
Results and Discussion .....	5
Indoor Air Hazards and Children’s Health: Brief Descriptions and Evidence.....	5
Sample Tools for Environmental Assessment of Children’s Homes .....	6
Tools Obtained.....	6
This tool was presented to the focus group for discussion (Appendix 4). Detailed comments are given in the Evaluation of the Pediatric Environmental Home Assessment Tool (Observational Tool) .....	7
Tool Elements Included in Tool Prototype and Rationale .....	12
Evidence on indoor air pollution effects.....	12
Formatting of Questionnaire Prototype .....	13
Focus Group .....	14
Purpose .....	14
Composition of the Focus Group.....	14
Processes of the Focus Group.....	15
Focus Group Assessment of the Tools .....	15
Current Tools in Use.....	15
Practical Uses and Appropriateness of Draft Questionnaire Prototype.....	16
Specific Comments on Air Contaminant Components .....	16
Evaluation of the Pediatric Environmental Home Assessment Tool (Observational Tool) .....	18
General Comments on the Assessment Tools .....	19
Analysis of Nurses’ Responses .....	20
Feedback on the Scientific Literature .....	20
A Case Study of the Network Capacity and Resources of New Brunswick Public Health Practitioners ..	21
Stakeholders .....	21
Collaboration and Communication.....	22
Needed Tools and Resources:.....	23
Potential Next Steps .....	24
Intra-provincial Collaboration.....	24
Interprovincial Collaboration .....	24
Limitations of the Study .....	25
Conclusion.....	25
References .....	27

**List of Appendices**

APPENDIX 1: Literature Review Search Parameters ..... 29  
    Search of the epidemiological literature on suspected and known indoor air contaminants for morbidity in children, early or later in life; ..... 29  
    Search for sample questionnaire checklists, observation forms and relevant measurement techniques. .... 29  
APPENDIX 2: Summaries of Selected Studies on Children’s Environmental Health ..... 30  
APPENDIX 3: Exposure to Indoor Air Contaminants: Assessment Questionnaire (Prototype)..... 38  
APPENDIX 4: Observational Assessment Tool ..... 46  
APPENDIX 5: Notes from the Focus Group Consultation..... 51

**List of Tables**

Table 1: Sample Assessment Tools ..... 7

### Acknowledgements

The author wishes to acknowledge the contribution of the seven New Brunswick public health nurses who provided feedback on sample Home Environmental Health Assessment tools and scientific literature, and shed light on what would be needed to enable public health practitioners to integrate home environmental health assessments into their day-to-day practice. A representative of a New Brunswick Early Intervention Program also provided feedback regarding scientific literature samples and their usefulness in that setting. As well, Dr. Helen Ward of the National Collaborating Centre for Environmental Health, provided helpful guidance on the project overall, as well as very useful suggestions in reviewing the drafts.

### Executive Summary

There were three topic areas that were explored in this study: 1) assessing evidence from the scientific literature on indoor air hazards to children's health; 2) selecting sample tools that are currently in use and 3) convening a focus group of New Brunswick public health nurses to provide feedback on the assessment tools as well as consider the network capacity of provincial public health practitioners to promote awareness of children's environmental health hazards.

Recent epidemiological literature was selected to provide evidence of health effects from indoor air hazards on human populations, with a focus on children. The hazards were categorized as: aeroallergens, gases, particulate matter, lead, and chemicals in environmental tobacco smoke, pesticides and volatile and semi-volatile organic compounds, and naturally occurring hazards.

The studies generally showed positive associations between indoor air pollution and health effects, particularly respiratory outcomes, in children. Mould and dampness were consistently related to multiple allergic and respiratory effects. Causal factors for asthma in children were found to be exposure to environmental tobacco smoke, proximity to busy roads and living in damp homes with visible mould. Exposure to volatile organic compounds (formaldehyde) was also associated with asthma in children. Exposures to nitrogen dioxide and to particulate matter were associated with respiratory symptoms and decreased lung function in children. Low-level exposure to lead, particularly from lead dust in deteriorating paint in older homes and from renovating activities, resulted in adverse neurobehavioral health outcomes in children. Positive associations with cancer, particularly childhood leukemia, were observed with pesticide exposure indoors in children and pregnant mothers and with radon exposure in homes.

A draft questionnaire prototype included tool elements on indoor air contaminants that were common to five selected sample assessment tools and confirmed by the scientific literature as posing risks to children's health. The elements included in the questionnaire prototype were: asbestos, lead, mould, radon, polyvinyl chloride (PVC), environmental tobacco smoke, dust mites, pests (cockroaches, rodents), furry pets, toxic cleaning products (including those containing ammonia and solvents), pesticides, phthalates, polybrominated diphenyl ethers (PBDEs), formaldehyde, benzene and nitrogen dioxide.

An existing observation tool, the "Pediatric Environmental Home Assessment" from the U.S. National Center for Healthy Housing, was selected as the representative observation tool. It included both resident-reported information and nurse observations on the home environment, including the sleep environment and home safety.

The focus group of seven New Brunswick community health nurses was instrumental in determining the type of assessment tool that would work - not only with the participants' clientele, but what they themselves would be most satisfied using. They noted that the goal of any environmental home assessment tool should be to address social determinants of health and respect the right of the child for conditions that support health, as declared in the UN Convention on the Rights of the Child. The guiding principle should be to minimize the risks to the children in the home. The focus group stressed the

## Environmental Health Risks in Children

---

importance of combining assessment with client education. The essential aspects of the tool design were to be comprehensive, client-friendly and educational.

Participants suggested that the assessment process use a two-step approach: 1) The home visitor could administer a comprehensive observational checklist that could be filled in over a series of home visits; and 2) together with the parents/family, the home visitor could use a supplementary info-graphic that incorporates both environmental and safety hazards as an educational tool. This was described to be the “optimal tool” for use with at risk families. As well, the target group for these home assessments should include couples at the pre-conception and prenatal stages.

An important observation was on the utility of questions asked of the family – if there are no prevention strategies or solutions available (as when the issue is outside of the family’s control, or there is no person or agency that the nurses can refer to for assistance), then asking the question is not useful. The following quote from the focus group meeting summarized the value of assessment: “A good assessment tool can be used as documentation – as evidence of the need for interventions; and also as an advocacy tool.”

In this regard, the focus group explored ways to maximize intra-and inter-provincial collaboration and communication by identified stakeholders to influence policy aimed at enhancing goals of improving children's environmental health. In addition to practical tools and resources needed by home visitors they stressed the need for evidence and best practices, partnerships and social networking, public awareness and education and communication strategies as well as linking to other initiatives, such as the Built Environment Network.

### Purpose

Given that Canadians, especially infants and young children, spend over 90% of their time indoors,<sup>1</sup> the National Collaborating Centre for Environmental Health has an interest in investigating indoor air quality and its impact on childhood development. In Canada, there is a scarcity of evaluation instruments specifically oriented to detecting environmental health risks at the preconception, postnatal and early childhood stages of development. This study seeks to lay the groundwork for creating tools, reflecting the Canadian context, which could be used by home visitors to detect environmental hazards in children's homes, and provide guidance to parents and guardians on reducing those hazards.

Specifically, this study seeks to:

- briefly identify recent scientific research on indoor air contaminants, particularly epidemiological reviews, which provide evidence of the health effects in children;
- obtain existing questionnaire, observation and measurement tools relevant to indoor air contaminants in the Canadian context, and develop a "tool prototype" for representative community health/public health nurses and paraprofessionals to assess for use during home visits when screening for indoor environmental health hazards to children;
- identify the network capacity and resources of one province (New Brunswick) by means of a focus group, to illustrate what supports, collaborations and communication vehicles would be needed by home visitors to incorporate home assessments of children's environmental health hazards into public health practice.

### Background

#### Children's Unique Vulnerability

Canadian children spend most of their time in indoor environments, where they can be exposed to potent moulds and antigens, chemicals particulate matter, gases, and naturally occurring hazards such as radon. In addition to indoor sources such as heating and cooking fuels and cleaning products, pollutants from outdoor air can drift inside and pesticides and other contaminants can be carried into the home on people's shoes or clothing and subsequently become embedded in household dust.

Children are at increased risk of absorbing airborne pollutants, due to their disproportionately greater exposures on a body-weight basis, their immature lung development (until late adolescence) and their different activity patterns.<sup>2</sup> Relative to adults, their intake of air, food and water is larger. For example, children's respiratory rates are twice the rate of adults and they inhale twice as much air. Behaviorally, young children are more active (breathing more rapidly) and ingest more contaminants through hand-to-mouth contact and they have greater contact with floors, carpets and other surfaces where contaminated dust gathers.

Airborne pollutants are especially hazardous during fetal development, when the vital organs are developing. Exposures of even minute quantities of pollutants during these sensitive periods of development can damage the brain, reproductive organs, immune system, and other organ systems.<sup>3</sup>

Environmental health risks to children from the indoor environments where they live, play and learn can result in morbidity in children, earlier or later in life, or even death. This paper will consider indoor air pollutants in particular, which include: particulates (e.g. PM<sub>2.5</sub>), gases (e.g. NO<sub>2</sub>), volatile organic compounds (VOCs) such as formaldehyde and benzene, semi-volatile organic compounds (SVOCs) such as phthalates, environmental tobacco smoke, biological hazards (e.g. moulds, antigens) and naturally occurring hazards (e.g. radon). The most common adverse health outcomes for children exposed to indoor air pollution include upper and lower respiratory tract symptoms, allergic diseases and asthma.<sup>4</sup>

### The Role of Home Visitors

Community health/public health nurses and allied paraprofessionals have a unique perspective on indoor air hazards. By working directly with families potentially affected by exposure to indoor pollutants and collaborating with other public health professionals, they are in an excellent position for advocacy, as Canada moves toward a greater recognition of the importance of healthier homes and the impact of indoor air quality on children's health. This project brought together seven community health/public health nurses who are currently providing (or had provided in the past) home visitation to families with children. Their feedback was sought on the utility of different tool types and components, and on successful implementation of new tools.

### Methodology

Two literatures searches were undertaken: 1) to identify seminal and recent reviews and primary epidemiological literature on suspected and known indoor air contaminants for morbidity in children, early or later in life; and 2) to identify sample questionnaire checklists, observation forms and relevant measurement techniques.

Recent reviews and primary studies in the epidemiological literature were searched using PubMed, Medscape and Science Direct. Search terms included: air pollution, air contaminants; indoor, housing, home, home environment, residence characteristics, preconception care, fetus, pregnancy, child, infant, environmental health, environmental pollutants, environmental exposure, risk assessment and hypersensitivity.

The search methodology for sample tools consisted of a scoping search of the grey literature, using Google. Websites included Canadian and international government agencies (federal, provincial, municipal), non-government organizations (Canadian and international; many health-related, some environment-related), coalitions or partnerships and professional associations. Search terms included: children's environmental health, environmental health assessment, indoor air hazards, assessment tool, screening tool, questionnaire, survey, checklist, observational tool, measurement tool, healthy homes and asthma screening.

- Tools were selected on the basis of their relevance for use in Canadian homes, whether the source was reputable and whether the instrument was accessible. Six instruments fit these criteria, of thirty citations found.
- For a more complete description of search parameters, please refer to [Appendix 1](#).

- Tool elements were selected if they indicated the presence and sources of exposure to common air contaminants. The elements included in the Tool Prototype fell within these categories: aeroallergens; gases; PM; lead; chemicals in Environmental Tobacco Smoke and pesticide sprays, volatile and semi-volatile organic compounds and naturally occurring hazards.

Three criteria helped to determine whether an element would be included in the Questionnaire Tool Prototype: 1) whether they were common to some of the six sample tools retrieved from the literature; 2) whether they were air contaminants, (as distinguished from water, food or other sources of contaminants); and 3) whether the collected scientific literature confirmed their risk to children's environmental health.

## Results and Discussion

- The results of this study are grouped under three categories: 1) indoor air hazards and evidence of their health effects on children; 2) sample tools, specific tool components, and the development of a draft tool; and 3) proceedings of a focus group consisting of a convenience sample of community health/public health nurses.

### Indoor Air Hazards and Children's Health: Brief Descriptions and Evidence

Twenty reviews and epidemiological studies were identified, examining the evidence of health effects from indoor air hazards on human populations, with a focus on children. The indoor air hazards were grouped as: 1) building exposures related to indoor air contaminants; 2) aeroallergens and irritants; 3) chemical exposures in the home; and 4) gases. A brief description of relevant findings from each study is given in [Appendix 2](#). A brief synopsis of the study findings is given below.

All of the studies showed positive associations between indoor air pollution and health effects in children. Mould and dampness had consistent positive associations with multiple allergic and respiratory effects. However, there is still little known about the causal agents that impact allergic respiratory disorders in children. Gases such as indoor nitrogen dioxide were associated with statistically significant increases in respiratory symptoms in preschool children. Exposure to indoor PM<sub>2.5</sub> was associated with decreased lung function in children, while increased asthma symptoms were more related to coarse PM concentrations.

Some of the landmark studies on lead (beginning in the 1970s and through the 1980s) provided sufficient evidence of associations between low-level exposure to lead and adverse health outcomes in children. Reduced IQ, auditory and speech processing, attention difficulties, and behavioural effects were associated with lead exposure. Recent studies have continued to show that it is the lead dust in deteriorating paint in older homes, and renovating activities that are the primary sources of lead exposure in children today. Additional evidence was provided for health effects in children at blood lead levels below 10 micrograms per deciliter.

Chemicals investigated included those found in tobacco smoke and pesticides. Causal factors for asthma in children were found to be exposure to environmental tobacco smoke, proximity to busy roads and living in damp homes with visible mould. Positive associations were observed between indirect pesticide

## Environmental Health Risks in Children

---

exposure in children and cancer, particularly leukemia. In addition, mothers exposed to pesticides during pregnancy had a greater risk of adverse birth outcomes.

Exposure to volatile organic compounds, such as formaldehyde, was associated with asthma in children and an increased incidence of lower respiratory infections.

A naturally occurring hazard of radon exposure in homes has been shown to have an association with an increased risk of childhood leukemia, as well as for acute lymphoblastic leukemia. Asbestos, a carcinogen that is banned or strictly regulated, still poses a potential danger if present in older buildings that are disturbed for renovations.

## Sample Tools for Environmental Assessment of Children's Homes

### Tools Obtained

The scoping search for sample tools resulted in twelve assessment tools, seven from the U.S. and four from Canada. One tool from the United Kingdom was considered to be out of scope as it was intended for research purposes and could not easily be adapted to the home visiting context. Thus, a total of eleven tools were retained.

Of the eleven tools collected, six were obtained prior to the focus group meeting and were used to inform the development of a Questionnaire Prototype, for assessment by the focus group. These were also sent in advance to the focus group participants as examples for their reference. Four of the six tools were questionnaire based, one was observation based and one had both observational elements and questionnaire elements.

Most of the tools assessed (nine) were in questionnaire format, one was in observational format and one had elements of both a questionnaire and an observational tool. No measurement tools were found. Five were to be self-administered by residents (three questionnaires and two checklists), one was designed to be administered by home visitors and one was designed for childcare operators (but could be adapted for use by home visitors). The focus of the tools varied: seven were focused on children, three on homeowners or tenants, and one was focused on the environment.

Table 1 summarizes the 11 sample assessment tools obtained and their characteristics.

Table 1: Sample Assessment Tools

Tool Name, Author, Year	Characteristics	Comments
<b>Observational Tools</b>		
<ul style="list-style-type: none"> <li>* Pediatric Environmental Home Assessment</li> </ul> <p>National Center for Health Housing, 2006 USA</p>	<p>Child-focused. 2 sections: Resident-reported information:</p> <ul style="list-style-type: none"> <li>General Housing Characteristics</li> <li>Indoor Pollutants</li> </ul> <p>Nurse-observed information:</p> <ul style="list-style-type: none"> <li>Home Environment</li> <li>Sleep Environment</li> <li>Home Safety</li> </ul>	<p>This tool was presented to the focus group for discussion (Appendix 4). Detailed comments are given in the Evaluation of the Pediatric Environmental Home Assessment Tool (Observational Tool)</p>
<ul style="list-style-type: none"> <li>* Asthma Home Environment Checklist</li> </ul> <p>Environmental Protection Agency, 2004 USA</p>	<p>Somewhat child focused. (Presence of stuffed toys included) Section on definitions and descriptions of allergens and irritants. Section on Building information, followed by: Section with Questions, check-boxes for the answers, and action steps for mitigation. Questions are categorized: Home Interior: second hand smoke, consumer products, heating and cooling systems. Room Interior: bedding and sleeping arrangements, type of floor coverings, upholstered furniture and stuffed toys, window treatments, cooking appliances, moisture control, pest control. Last page: Educational resources, websites and Notes section to record triggers and mitigations suggested.</p>	<p>This tool has some of the attributes of an observational tool, and some of the attributes of a questionnaire (i.e., many of the questions could be answered through observation alone.). It was not presented to the focus group for discussion, but was heavily drawn upon for choosing elements for the draft tool.</p>

## Environmental Health Risks in Children

Tool Name, Author, Year	Characteristics	Comments
<b>Questionnaires</b>		
<ul style="list-style-type: none"> <li>* Environmental Health Assessment Guide for a Home and Family ©University of Maryland School of Nursing, 2002. USA</li> </ul>	<p>Home focused: Includes: Educational Resources and websites.</p> <p>Questions are related to general building characteristics (including age of home, paint conditions, heating), and home interior (including furniture, carpeting, curtains, hobbies, furry pets, mould/mildew, household cleaning products, pests and use of pesticides)</p> <p>Each question accompanied by text boxes with descriptions of: Potential Health Effects; Related to (sources, etc.) and Resources.</p>	<p>This tool was drawn upon for the selection of elements for the draft tool.</p>
<ul style="list-style-type: none"> <li>* Pediatric Environmental History (0-18 years of age): The Screening Environmental History National Environmental Education Foundation (no date found) USA</li> </ul>	<p>Child focused.</p> <p>First page: Notes that questions pertain largely to the child's primary residence, but that all indoor spaces where the child spends time should be considered.</p> <p>There are 14 screening questions. If a positive response is elicited, there is a follow-up list of supplemental questions under these categories:</p> <p>General Housing Characteristics; Indoor Home Environment; Air Pollution / Outdoor Environment; Food and Water Contamination; Toxic Chemical Exposures; Occupations and Hobbies; Health-related Questions</p>	<p>This resource uses a medical lens, and focuses on taking a medically-oriented history from patient or patient's family.</p> <p>Uses a pleasing, uncluttered format.</p> <p>The formatting and two-phased approach (one-page of screening questions plus follow-up questions) make it an interesting resource that could be used as a model for developing a tool for home visitors.</p>

## Environmental Health Risks in Children

Tool Name, Author, Year	Characteristics	Comments
<ul style="list-style-type: none"> <li>* Environmental History Form for Pediatric Asthma Patient</li> </ul> <p>National Environmental Education Foundation (no date found) USA</p>	<p>Child-focused.</p> <p>First page specifies that questions related to the child's home also apply to other indoor environments where the child spends time.</p> <p>Questions focus on:</p> <ul style="list-style-type: none"> <li>season, time, location, climatic conditions when the child's asthma is worse</li> <li>triggers</li> <li>stuffed animals</li> <li>carpets</li> <li>furry pets</li> <li>rats, mice, cockroaches</li> <li>smoking</li> <li>mould/mildew</li> <li>renovations, new carpets, etc.</li> <li>hobbies with fumes</li> <li>outdoor air pollution</li> <li>heat sources – wood stove, gas appliances</li> <li>other irritants (perfumes, cleaning agents or sprays?)</li> </ul>	<p>Medically-oriented.</p> <p>One page.</p> <p>Uses a pleasing, uncluttered format.</p>
<ul style="list-style-type: none"> <li>Taking an Exposure History</li> </ul> <p>Environmental Health Clinic, Sunnybrook and Women's College Health Sciences Centre</p> <p>Ontario College of Family Physicians</p> <p>Compiled by Dr. Lynn Marshall.</p> <p>(no date found) Canada</p>	<p>Environment focused: This is a comprehensive, medically-oriented exposure history that covers environmental exposures from the community, home and hobbies (building characteristics, vehicle, use of pesticides, mould, lead, gas, VOCs, allergens, environmental tobacco smoke and chemicals.)</p> <p>Also covers more general exposures, i.e., occupational, personal (natural inhalant allergies, synthetic chemicals, artificial materials in the body, e.g., dental amalgam, and smoking), travel illnesses, stresses, diet and drugs.</p>	<p>Medically-oriented.</p> <p>Some questions could be adapted for use in a screening tool for home visitors.</p>

## Environmental Health Risks in Children

Tool Name, Author, Year	Characteristics	Comments
<b>Self-administered Checklists and Questionnaires</b>		
<ul style="list-style-type: none"> <li>* Environmental Exposure Assessment</li> </ul> <p>©2011 Katie Huffling Katie Huffling, RN, MS, CNM Director of Programs Alliance of Nurses for Healthy Environments 240.753.3729 USA</p>	<p>Child focused: Intended as a do-it-yourself questionnaire for pregnant women and women of child-bearing age.</p> <p>Includes graphics, and is set up in a table format, with questions, answers, a section on Why do we ask this question? and Steps to Reduce Risks.</p> <p>Includes sections on:</p> <ul style="list-style-type: none"> <li>• Home/apartment</li> <li>• Pesticides</li> <li>• Smoking</li> <li>• Thermometer, compact fluorescent light bulbs</li> <li>• Chemicals, strong smelling cleaning supplies, air fresheners, plug-ins, incense</li> <li>• Fragrant personal care products</li> <li>• Eating – fish, fruits, vegetables, canned, organic</li> <li>• Microwaving in plastic</li> <li>• Use of water bottles</li> <li>• Renovations</li> </ul>	<p>This tool was a favorite of the nurses in the focus group. They strongly agreed with having a tool especially for women and couples of childbearing age. They especially liked the use of graphics and the sections on “Why do we ask this question?” and “Steps to Reduce Risks.”</p> <p>They noted that it was not all-inclusive; would need to be adapted for use by home visitors in NB.</p> <p>* The author of the tool would like to be kept informed of our progress and would potentially want to schedule a “work group” call with us, where we would discuss our initiatives here in Canada.</p>
<ul style="list-style-type: none"> <li>Home Environment Checklist</li> </ul> <p>Thunder Bay District Health Unit, 2008 Canada</p>	<p>Child-focused.</p> <p>Not Focused on the presence of contaminants, but on the lifestyle changes that a family could make to reduce the environmental risks to their children and family.</p> <p>Organized in chart format according to these sections: the home, bathroom, living room, kitchen, bedroom, laundry room, garage, yard, community</p> <p>Last page: web links and contact information</p>	<p>Format: family-friendly, colourful graphics and accessible literacy level.</p> <p>Not intended as a screening tool.</p> <p>Would serve as an information tool to support a family in making more environmentally-friendly choices.</p> <p>Also provides a starting point for education-focused conversations with the home visitor.</p> <p>Does not include rationale as to why certain lifestyle changes were included.</p>

## Environmental Health Risks in Children

Tool Name, Author, Year	Characteristics	Comments
<ul style="list-style-type: none"> <li>Appendix B: Environmental Health Childproofing Checklist: for Early Learning and Child Care Facilities Canadian Partnership for Children’s Health and the Environment, Playing It Safe: Service Provider Strategies, 2006 Canada</li> </ul>	<p>Child-focused.</p> <p>First page: Checklist to determine environmental safety of the child care facility for pregnant women and/or children – with questions under these categories: The facility, the activity/learning areas, bathroom/change area, kitchen and outdoors.</p> <p>Subsequent pages: for each question asked, the rationale and action steps are provided.</p>	<p>Format – clear, concise, easy to use.</p> <p>This tool could be adapted for home visitors to use in clients’ homes.</p> <p>Could be adapted as an observational tool.</p>
<ul style="list-style-type: none"> <li>The Toxic Nation Challenge: Make your Home a Healthy Home. (a checklist) Environmental Defence (no date found) Canada</li> </ul>	<p>Home Focused on anyone who lives in a residence.</p> <p>Only includes toxic chemicals.</p> <p>Organized by: living room, kitchen, bedroom, bathroom, nursery, home office, basement and garden. Also contains web resources and glossary.</p> <p>Identifies things “to avoid” and “to use instead”.</p>	<p>User-friendly, clear, informative, pleasing format.</p> <p>Aeroallergens and air contaminants from heat sources are not included.</p> <p>Rationale is not provided.</p>
<ul style="list-style-type: none"> <li>Master Home Environmentalist: Do-it-yourself Home Environmental Assessment List (HEAL) Clean Air for Kids Partnership (American Lung Association and 8 other partners) (no date found) Tel: 253-798-2954 USA</li> </ul>	<p>Home focused: This is an assessment and action tool for home owners and tenants.</p> <p>Consists of a questionnaire survey and an action plan.</p> <p>Survey topics: building, nearby environment, dust and lead control, moisture problems, indoor air, hazardous household products, pesticides.</p>	<p>Format: at first glance, appears clear – categories are not distinct, level of concern and action steps may be confusing for some.</p> <p>Requires a fairly good literacy level.</p> <p>No rationale was provided for the questions asked.</p>

\* Indicates tools that were sent to focus group participants in advance, as examples.

### Tool Elements Included in Tool Prototype and Rationale

The two tools assessed in depth by the focus group were the Questionnaire Prototype ([Appendix 3](#)), and the observational tool, the Pediatric Environmental Home Assessment ([Appendix 4](#)), both of which were circulated in advance of the focus group. The selection of tool elements and formatting style for the Tool Prototype for testing with the focus group were informed by five questionnaire-based instruments and the observational tool.

- *Pediatric Environmental History (0-18 Years of Age)* and supplementary questions The Screening Environmental History, National Environmental Education Foundation
- Environmental History Form for Pediatric Asthma Patients, National Environmental Education Foundation
- *Asthma Home Environment Checklist*, Environmental Protection Agency, 2004
- Environmental Health Assessment Guide for a Home and Family, ©University of Maryland School of Nursing, 2002.
- *Environmental Exposure Assessment* (for pre-conception and prenatal women), ©Katie Huffling, 2011
- *Pediatric Environmental Home Assessment*, National Center for Health Housing, 2006 (observational tool )

### Evidence on indoor air pollution effects

Relevant studies providing evidence of an association between exposure to indoor air pollution and health effects in children are given below, according to type of contaminant.

#### *Building exposures related to indoor air contaminants*

- Asbestos: Murphy and Sandel, 2014<sup>5</sup>
- Lead: Needleman et al., 1979<sup>6</sup>; Rice, 1996<sup>7</sup>
- Mould: Mendell et al., 2011<sup>8</sup>; Tischer and Heinrich, 2013<sup>9</sup>
- Radon: Tong et al., 2012<sup>10</sup>
- Polyvinyl chloride (PVC): Environmental Protection Agency, 2013

#### *Aeroallergens and irritants*

- Second Hand Smoke: Breyse et al., 2010<sup>11</sup>; WHO, 2005; Heinrich, 2011<sup>12</sup>
- Dust mites: Kelly et al., 2012<sup>13</sup>
- Pests (cockroaches, rodents): Kelly et al., 2012<sup>13</sup>
- Furry pets: Kelly et al., 2012<sup>13</sup>

### *Chemical exposures in the home*

- Volatile Organic Compounds (VOCs): U.S. Environmental Protection Agency, 2010<sup>14</sup>
- Formaldehyde: Roda et al., 2011<sup>15</sup>; McGwin et al., 2010<sup>16</sup>
- Benzene: WHO, 2010<sup>17</sup>; Environmental Protection Agency, 2013<sup>18</sup>
- Toxic cleaning products, including those containing ammonia and solvents: Murphy and Sandel, 2014<sup>5</sup>; LeCann et al., 2011<sup>19</sup>; Heinrich, 2011<sup>12</sup>

### *Semi-Volatile Organic Compounds (SVOCs):*

- Pesticides: LeCann et al., 2011<sup>19</sup>; Heinrich, 2011<sup>12</sup>
- Phthalates and semi-volatile organic compounds: Heinrich, 2011<sup>12</sup>; Environmental Protection Agency, 2013<sup>20</sup>
- Polybrominated diphenyl ethers (PBDEs): Environmental Protection Agency, 2013<sup>20</sup>

### *Gases*

- Nitrogen Dioxide: Breyse et al., 2010<sup>11</sup>

### **Formatting of Questionnaire Prototype**

The consultant chose formatting and categories for the Questionnaire Prototype to be similar to that of the Environmental Exposure Assessment Checklist and questionnaire by Huffling, ©2011. For each contaminant it included a brief description of sources, the question, the client's answer, the rationale for the question, and action steps to reduce risk. The Questionnaire Prototype was revised based on feedback from focus group participants and the final version appears in [Appendix 3](#).

### Focus Group

A focus group of seven participants selected from a convenience sample of community health/public health nurses, met on February 25, 2014 in the Birchview Room of the Regional Health Authority Office at 300 St. Mary's Street in Fredericton, New Brunswick. One additional participant, a coordinator of an early intervention home visiting program, was unable to attend the focus group, but offered comments on the value of the scientific literature received.

### Purpose

The objectives of the focus group were four-fold:

- To provide feedback on whether they had ever used, or were currently using, a screening tool for the purpose of assessing household environmental risks to children. If so, to describe the tool or bring a paper copy of it.
- To provide feedback on two tools: 1) A draft Questionnaire, using tool elements selected by the consultant, for the purpose of identifying the most appropriate types of questions and observations to assess selected environmental health hazards. 2) An observational tool. Measurement tools were not included in the exercise, as there had been none identified in the literature at that point in time.
- To provide their thoughts and suggestions on ways to improve collaboration and communication between government, public health, nurse professionals and allied paraprofessionals intra-and inter-provincially for evaluating and preventing environmental health hazards which impact children. This would include supportive provincial resource contacts; professional development needs; tools, resources and ongoing support that would be needed for the broad adoption of the tools in their workplaces.
- To provide feedback on whether they would be interested in using the scientific literature resources to support their home visiting practice (or other nursing practice, for those not actively engaged in home visiting); if so, in what way would they see using the research? And what types of scientific literature, from which sources, would be most helpful?

### Composition of the Focus Group

Participants were approached from a sample of community health/public health nurses, allied paraprofessional home visitors, and various other relevant public health practitioners whose agencies were currently collaborating on the issue of children's environmental health, i.e., the NB Children's Environmental Health Collaborative ("Team Nurses"), the Department of Health and the Nurses Association of New Brunswick. From this pool, eleven individuals were invited to participate, and seven nurses accepted. One representative from the early intervention home visitor program had planned to attend, but that person had to cancel unexpectedly.

Of the seven who participated, two were working in community health nursing doing home visiting as the main focus of their practice, one with First Nations. A third was in a coordinating role, but still maintained a home visiting practice as well as conducting prenatal and healthy toddler assessments. The

## Environmental Health Risks in Children

---

remaining four participants had all done home visiting earlier in their careers: one was a Coordinator for the Healthy Babies Healthy Families Program; one was with the Healthy Learners Program in schools; one was with the Department of Health, Office of the Medical Officer of Health, within the Healthy Environments Branch; and one was currently with the New Brunswick Nurses Association.

### Processes of the Focus Group

- Permission was requested and granted to record the proceedings. Flip chart notes were taken to capture essential points, and sticky notes were provided to each participant, for posting on the flip chart important points not to be missed. Flip chart pages were used to gather data on their satisfaction with the questionnaire and the observational tool on a five-point scale, and to record data on the Collaboration and Communication section. All participants were consulted on the accuracy of the flip chart notes and the notes being taken by hand during the meeting and sent a copy of the collected data to confirm accuracy. The numbers of participants responding to a specific question was also recorded.
- The consultation proceeded in two parts: 1) assessing the tools, in which is discussed the current tools in use, as well as the practical uses and appropriateness of the two tools presented for discussion; and 2) a case study of the network capacity and resources of New Brunswick public health practitioners to integrate new environmental health home assessment tools into public practice.

### Focus Group Assessment of the Tools

#### Current Tools in Use

None of the participants was currently using a screening tool specifically aimed at determining environmental health risks for children; however, two of the nurses shared a couple of parent education tools that they were using with client families.

The Canadian Partnership for Children's Health and the Environment offers a series of pamphlets on "environmental childproofing". One brochure, titled "Creating Healthy Environments for Kids", summarizes the key messages from the six other related pamphlets on the topics of fragrances, managing house dust, eating fish safely, using green cleaning supplies, dealing with plastics, and safe renovation practices. The web address is:

<http://www.healthyenvironmentforkids.ca/resources/creating-healthy-environments-kids>

Healthy Child Healthy World, a California based non-profit organization dedicated to "empowering parents to take action and protect children from harmful chemicals", recently published the infographic, "Hidden Dangers in your Baby's Nursery". This tool identified some of the "invisible risks" that exist in a newly decorated baby nursery, and provided guidance on how to avoid them. The health and safety risks pertained to the crib, crib mattress, changing table, paint, baby care products and toys. The web address is: <http://healthychild.org/hidden-dangers-in-your-babys-nursery/>

Participants agreed that they were useful tools. They felt they would make excellent teaching tools, as they presented information in an engaging way (colourful, simple, and straightforward, *with solutions*).

## Environmental Health Risks in Children

---

The tools are not intimidating for families, and they are accessible and easy to understand, making conversations with families easier on these topics. The inclusion of action steps or solutions was seen to be critical.

### Practical Uses and Appropriateness of Draft Questionnaire Prototype

- This tool, consisting of tool elements selected by the consultant, was distributed to the participants in advance. The elements were chosen to assess for the presence and sources of suspected and known indoor air environmental health hazards that can cause morbidity in children, early or later in life.

#### *Overall Rating*

Participants ranked the draft Questionnaire on a five-point scale, with all seven respondents indicating it was 'relevant' or 'very relevant' to their work. For 'ease of application', results were mixed, with three giving it a neutral rating, and three indicating it was 'somewhat easy' to apply. For comprehensiveness, five indicated it was 'very comprehensive', and one gave it a neutral rating. While the content was considered relevant and, for the most part, comprehensive, the tool itself was considered a poor fit for the families with whom the nurses work. Its literacy level was beyond that of most of their families, and the tool did not provide the opportunity for education while the nurse was discussing the content with families.

### Specific Comments on Air Contaminant Components

Participants' comments reflected their many diverse perspectives. They all agreed that each question should be accompanied by a section on Rationale (why the question was included) and a section on Action Steps – for the family and the nurse (if referral is needed). They also suggested that PVC, PBDEs, NO<sub>2</sub> and benzene were important additions, and these were incorporated into the final version of the Questionnaire Prototype ([Appendix 3](#)).

Specific comments are described below.

#### *Aeroallergens*

##### **Mould:**

- Include in the Action Steps the name of a product that would be safe to use for killing mould spores.
- For literacy level, use alternate wording, such as "Do you notice a musty smell in your home?"
- Anecdotal story of a newborn baby arriving home to an extremely mouldy home, which was subsequently condemned. The system had no safety net measures for alternate housing, so the family was left homeless. (An example of a lack of coordination among the parts of the system in the best interests of the family.)

##### **Dust mites:**

- It was noted that many low rental units have carpeting, and the families cannot usually afford a vacuum.

## Environmental Health Risks in Children

---

### Furry pets:

- Stressed the importance of damp-dusting, damp-mopping and limiting the number of pets.

### *Gases*

#### **Carbon Monoxide:**

- It was noted that most families would not have CO meters installed in their homes.

#### **NO<sub>2</sub>:**

- The section on NO<sub>2</sub> should receive greater emphasis

### *Particulate Matter*

- Anecdotal stories of newborn babies arriving home where wood stoves were the main source of heat.

### *Lead*

- Need to include information on lead in jewelry, lunch bags, toys, trinkets, etc. Some frustration was expressed regarding the gap in regulation and policy, and how policy changes were needed, and protocols put in place. For example, if there were obvious chipping lead paint in an older home, to whom would they refer that observation?

### *Chemicals in Tobacco Smoke and Pesticide Sprays*

#### **Second hand smoke:**

- The questionnaire should identify the specific substance being smoked – tobacco, marijuana, sweet grass, flavoured marijuana in the hookah pipe, etc. There needs to be more education on “third-hand smoke”, i.e., the smoking residues that cling to clothing, furnishings, etc. Nurses appreciated the plain language guideline for third-hand smoke: “If you smell smoke, you are breathing in smoke.”

#### **Pesticides:**

- The participants suggested that pesticide free treatments and natural products be included as alternatives to pesticides, for discussion with the client.

### *Volatile and Semi-Volatile Organic Compounds*

- Determining the presence of strong-smelling cleaning agents, air fresheners, and personal care products were noted as being an essential part of any screening tool.
- Green alternatives should be part of the recommended action steps.
- The sections on phthalates, PBDEs and solvents such as benzene should receive greater emphasis. In particular, more emphasis should be placed on the hazards associated with fragrances in consumer products - air fresheners, personal care products, cleaners, etc, and safer alternatives.

### *Naturally Occurring Hazards*

- Asbestos:
- The year when asbestos was regulated out of insulation should be included.
- Where do we draw the line between what is our role and what is an inspector's role?
- Radon:
- Clients may not have access to testing for this contaminant, as there is a cost.

### **Evaluation of the Pediatric Environmental Home Assessment Tool (Observational Tool)**

- This tool was selected by the consultant as a good example of an observational tool, and was distributed to the participants in advance. (See [Appendix 4](#)). It was designed by the US National Center for Healthy Housing, for use by home visitors.
- Participants' ratings were positive. Six of seven participants felt the tool was either very relevant or relevant to their work. In terms of ease of application, four respondents felt it was very easy to administer, two felt it was somewhat easy, and one was neutral. For comprehensiveness, all participants felt it was either somewhat or very comprehensive.

### *Positive attributes*

- Several commented that they liked the injury prevention component being woven into the tool.
- The section on sleep environment was considered very important, as many children spend a lot of time in their bedrooms with their electronic devices.
- Liked the ease of using check boxes - more user-friendly.
- Liked the progression from "most safe" to "most hazardous" (left to right).
- Felt it was a comprehensive tool, and easy to use by home visitors.

### *Gaps in the observation tool*

- There was no mention of Lice
- Heat pumps should appear under heating, as a good option for furnaces.
- The toxicity of cleaning products was not given.
- Pesticides, phthalates, ammonia, formaldehyde were not covered.
- Proximity to heavy traffic areas, industrial sites, landfills, hazardous waste sites

### *Other Comments*

- It is more of a screening tool, the solutions aren't provided.
- One commented, "Not sure if I would feel comfortable just asking all these things without some type of teaching tool to go with it".

### Recommendations

- Most felt the observational tool would be best administered over a series of visits, with the paperwork being completed after returning to the office.

### General Comments on the Assessment Tools

- There was a consensus that the goal of any environmental home assessment tool is to address social determinants, among other determinants of health and to respect the right of the child for conditions that support health (UN Convention on the Rights of the Child).
- The importance of combining assessment with client education was passionately promoted. This calls for a tool design that is comprehensive, client-friendly and educational.
- Participants put forward the suggestion that the assessment process could use a two-step approach: 1) The home visitor could administer a comprehensive observational checklist that could be filled in over a series of home visits; and 2) together with the parents/family, the home visitor could use a supplementary info-graphic that incorporates both environmental and safety hazards as an educational tool. This was described to be the “optimal tool” for use with at risk families.
- The target group for these home assessments should include young couples who are living in their own homes, but do not yet have children. As well, pregnant women need to have access to a prenatal home assessment and the subsequent action steps to make their pregnancies as safe as possible for their unborn child.
- A selection of sample tools had been sent out in advance of the focus group, and of these tools, several participants mentioned the positive attributes of the “Environmental Exposure Assessment” by Katie Huffling © 2011 (a tool for women of child bearing age –prenatal and pre-conception). They liked the colourful, user-friendly format, the section “Why do we ask this question?” (an opportunity to educate while administering the tool), the section “Steps to Reduce Risks” (commenting that every question asked should include action steps) and the accessibility of the language, e.g., “If you smell smoke it means you are breathing in smoke.”
- There was a discussion surrounding the utility of questions asked of the family – if there are no prevention strategies or solutions available (as when the issue is outside of the family’s control, or there is no person or agency that the nurses can refer to for assistance), then asking the question is not useful. The participants suggested that the optimal tool would have sections for items that are within the family’s control, activities that would be the landlord’s responsibility and action steps that the nurses could take (often in conjunction with the family), if relevant.
- Participants suggested certain guidelines be used in the development of the tool: The tool should minimize the risks to the children in the home, while making sure that the remedial measures are within the family’s control (with home visitor’s support, when needed).
- The primary gaps identified related to literacy level, the need for French translation and the suitability of some of the questions, being on topics outside the client’s control. In addition, not

many of the questions addressed the degree of pollution from indoor air contaminants within the home.

- And finally, a quote from the meeting: “A good assessment tool can be used as documentation – as evidence of the need for interventions; and also as an advocacy tool.”

### Analysis of Nurses’ Responses

Not surprisingly, the nurses’ responses to the questions reflected their professional practice. Those nurses who were most directly engaged with clients provided responses that were more relevant to the clients’ perspectives, and tended to be of a more practical nature. For example, under the topic “tobacco smoke”, one of the nurses suggested that the type of substance being smoked should be broadened to include marijuana, the burning of sweet grass, etc. This suggestion was made by one of the nurses whose practice consisted of home visits to the homes of families at risk.

In contrast, the nurses who had moved into policy positions, or into prevention programs in the schools tended to provide responses that reflected the “bigger picture”, for example, the comment that “the goal of any environmental home assessment tool is to address social determinants, among other determinants of health, and respect the right of the child for conditions that support health (UN Convention on the Rights of the Child)”.

Based on these observations, it is recommended that future focus groups on this topic include those with a mix of perspectives, in order to capture practical as well as policy-oriented feedback. However, with respect to the design of future screening and educational tools, the mix of participants should be more heavily weighted to the practical perspective, to ensure the tools appeal to the target audience.

### Feedback on the Scientific Literature

Following the focus group, the participants were invited to comment on the types of scientific literature that would be useful to support their nursing practice. They were sent three examples of evidence-based literature to review: one academic literature review, one primary study and one evidence-based fact sheet. These were chosen to reflect situations that home visitors would encounter on a regular basis, e.g., children with asthma living in homes with cats present and children living in substandard homes with chipping lead paint. The literature described the links between children’s health and their indoor environments.

Five of the seven focus group participants responded. One additional participant responded who did not attend the focus group, but wished to offer comments on the literature. She represented a group of allied professionals – early intervention home visitors. In total there were six responses, four of which were detailed. Two of the responses were from nurses who were not currently making home visits.

Generally, all of the six responses were positive, reflecting an agreement that to have up-to-date research evidence from credible sources would greatly enhance their day-to-day practice in their work. The two nurses not currently making home visits did not provide additional responses beyond the agreement that research would be helpful in their work.

## Environmental Health Risks in Children

---

In general, responses reflected the participants' view that they need better tools and methods with which to educate themselves and their clientele. The four participants who gave detailed responses indicated a preference for the Fact Sheet on lead, which they saw as a tool that could be adapted for use as a learning tool for families and even for staff. Two respondents indicated an appreciation for the original studies, particularly the review on indoor air, as a way of building their own knowledge base.

Other responses of note include the observation that gathering relevant research evidence is currently an individual professional responsibility. One participating nurse commented that currently they share information among each other on an informal basis, but that this strategy opens up the possibility of clients receiving conflicting information from different professionals. She stressed that, when sharing information with families, it is important for all nurses to work from the same evidence-based information. Another participant, the early intervention coordinator, suggested that her program could use such information as an opportunity to educate, if the families were receptive.

### A Case Study of the Network Capacity and Resources of New Brunswick Public Health Practitioners

- The focus group of public health nurses provided an opportunity to conduct a brief case study of the networks and resources that are available in New Brunswick to promote and support the development of tools and resources to reduce children's exposures to air contaminants. The nurses identified key stakeholders, commented on current levels of collaboration and coordination among stakeholders and what needs to happen to improve these levels, and offered their insights on the next steps, both intra-provincially and inter-provincially.

### Stakeholders

Focus group participants generated a list of stakeholders within New Brunswick whose participation and support could contribute to the issue of healthier indoor air quality in children's homes in New Brunswick. Some of these stakeholders had already recognized that there were issues relating to indoor air quality within their mandates. Participants also recognized the need for an additional stakeholder group whose mandates addressed the issue of air quality from an "upstream" perspective.

#### *Government agencies – provincial:*

- Department of Health, the Office of the Chief Medical Officer of Health
- Department of Social Development (Housing)
- Department of Healthy and Inclusive Communities
- Department of Environment and Local Government
- Department of Education and Early Child Development
- Office of the Rentalsman
- Office of the Child and Youth Advocate

## Environmental Health Risks in Children

---

### *Government agencies – federal:*

- Military (there are major housing concerns on the military base at CFB Gagetown)
- Federal agencies
- First Nations, locally and at federal level

### *Government agencies, regional:*

- Regional Health Authorities (e.g., Healthy Learners in Schools Program)
- Municipalities, particularly City of Fredericton and other health-aware municipalities;

### *Non-government agencies:*

- New Brunswick Lung Association

### *Health professionals and allied professionals:*

- Physicians, e.g., Tanya Wood of Boiestown
- Practising nurses
- Nurse Practitioners (Kate Burkenholder)
- Pre-natal care providers

### *Professional Associations:*

- New Brunswick College of Family Physicians
- New Brunswick Medical Society
- New Brunswick Nurses Association

### *Upstream stakeholders:*

- Engineers, architects and City and Rural Planners (For better building construction and community design)
- Public speakers on environment (e.g., Carl Duivenvoorden, Al Gore Messenger)

## Collaboration and Communication

### *Current level of collaboration and communication among stakeholders:*

This topic was only briefly discussed, as the participants perceived a very minimal level of collaboration among stakeholders. Comments were:

- “Needs improvement” (understatement!)
- The New Brunswick Lung Association holds an annual symposium of multi-stakeholders interested in air quality and lung health.

## Environmental Health Risks in Children

---

### *What needs to happen to improve collaboration and communication among stakeholders within NB?*

- The focus group participants concentrated their comments along three themes: main messages/guiding principles; engagement, and opportunities for collaboration / next steps.

### *Main Messages / Guiding Principles*

- Whatever is put forward to our stakeholders has to have relevance to their mandates.
- Healthy Homes are our collective mandate.
- A healthy home is a child's right.

### *Engagement*

- Parental engagement (through education)
- Youth engagement (through school involvement)
- NB Children's Environmental Health Collaborative

### *Opportunities for Collaboration / Next Steps*

- Public awareness and education strategy (Recall the introduction of our smoke-free legislation).
- We will need a communication strategy.
- We will need working groups.
- Leadership
- Conferences
- Loving Care booklets from the Department of Health need to include environmental aspects.  
<http://www2.gnb.ca/content/dam/gnb/Departments/h-s/pdf/en/HealthyPeople/LovingCare1to3Years.pdf>
- We need to tap into the Built Environment Network that is just forming.

### **Needed Tools and Resources:**

#### *Tools and resources needed to facilitate the broad adoption of measures to improve the health of children within their homes*

- Participants' comments often ranged beyond the specific focus of the question. However, some needed tools and resources were identified, including a broad policy framework, and some potential next steps
- Practical tools for home visitors to use with families, e.g., info graphics
- The development of educational materials
- Need evidence and best practices
- Social networking

## Environmental Health Risks in Children

---

- A policy framework is needed, such as an inter-sectoral Healthy Homes Strategy for New Brunswick.

### Potential Next Steps

- Partnerships, e.g., for the development of educational materials
- Link with the Poverty Reduction Strategy
- Influence public policy.

### Intra-provincial Collaboration

One response was given to existing mechanisms that could facilitate inter-sectoral collaboration within the province on the topic. (This question came toward the end of the focus group session).

#### *Existing mechanisms that could facilitate inter-sectoral intra-provincial collaboration*

- NB Children's Environmental Health Collaborative – list serve and conferences. (This Collaborative is truly multi-sectoral, having at least 20 different sectors participating, and a provincial reach.

#### *Single sector organizations that could be approached to collaborate on the topic of healthier homes for children in NB:*

- Nurses Association of New Brunswick – position statement
- NB Medical Society – in-service, position statement
- Peri-Natal Support Group (an influential prenatal health-oriented group)

### Interprovincial Collaboration

There were two suggestions that met the intent of this question.

#### *Mechanisms/Stakeholders that could be put in place for inter-provincial collaboration:*

- Inter-sectoral conferences – such as People Matter, a national conference sponsored by the Canadian Institute of Planners, and being held this year in Fredericton. The Nurses' Team of the NB Children's Environmental Health Collaborative has been accepted to do a presentation at the conference.
- Healthy Canada by Design, a partnership of national health, planning and transportation organizations, regional and local health authorities, non-government organizations and university researchers has launched a project titled: Coalitions Linking Action and Science for Prevention (CLASP): with a focus on creating built environments to reduce chronic disease. New Brunswick is actively involved with this group, and is developing a network of interested participants in the province.

(See special 2012 supplement of the Canadian Journal of Public Health: <http://journal.cpha.ca/index.php/cjph/issue/view/297> <http://journal.cpha.ca/index.php/cjph/issue/view/297> )

### *Other organizations that could be approached to contribute to an inter-provincial partnership:*

- Canadian Medical Officers of Health – They meet together on a regular basis.
- Canadian Association of Schools of Nursing – very active, possible partnership
- Canadian Nurses for Health and the Environment - they are on Facebook and have a newsletter.
- Canadian Nurses Association – active on the environmental health file
- Université de Moncton – current research ongoing re: environmental health and children (re: manganese exposure)
- National Interest Group of Nurse Practitioners – an active group
- NB-PEI Public Health Association – healthy homes is relevant to their mandate
- Family Physician conferences -
- Conferences of other health professional groups
- National Collaborating Centre for Environmental Health – may be interested in finding partners to promote healthier homes for Canadian children??

The complete record of deliberations of the focus group is found in [Appendix 4](#).

## Limitations of the Study

The main limitation of this study was the limited amount of time available to conduct the research project. The study was also limited by the narrow composition and small number of focus group participants. Only three participants were recruited whose role currently included active home visiting. The other four participants had done home visiting in the past to varying degrees. In addition, we were unable to recruit to the focus group meeting a representative of the Early Intervention Home Visiting Program. However, the coordinator of this program provided feedback on the scientific literature.

Another limitation was the scope of literature searches that were possible, given a short time frame for the completion of the study. Scoping searches were undertaken, but more in-depth searches would most certainly yield much more evidence on childhood environmental health risks but also, more examples of instruments for assessing these risks. Notably, only one international questionnaire (outside of North America) was accessed, but proved irrelevant, and no measurement tools were found that would be useful for determining the extent of exposure to a number of indoor air contaminants.

## Conclusion

This study identified current and seminal research on indoor air hazards to children’s health and sample environmental home assessment tools, examined their relevance to the needs of public health home visitors in New Brunswick, Canada and collated focus group deliberations regarding collaborations, communications and supports that would be needed to facilitate implementation of new tools for assessing home environments for environmental hazards.

## Environmental Health Risks in Children

---

From the scoping search for sample tools, twelve relevant tools were found; seven of these tools were of US origin, and four were Canadian. No measurement tools were found. A more in-depth scoping review of the literature is recommended to identify additional observational and measurement tools, and tools from the larger international community which could be adapted to the Canadian context.

The elements included in the questionnaire prototype were: asbestos, lead, mould, radon, polyvinyl chloride (PVC), environmental tobacco smoke, dust mites, pests (cockroaches, rodents), furry pets, toxic cleaning products, including those containing ammonia and solvents (benzene), pesticides, phthalates, polybrominated diphenyl ethers (PBDEs), formaldehyde and nitrogen dioxide (NO<sub>2</sub>). An existing observation tool was also assessed. The focus group discussion was useful in providing insights on the type of assessment tool that would work - not only from the perspective of the home visitor but also with consideration of the family's perspective. They identified gaps in what hazards are assessed and how best to communicate hazards to the family, considering their circumstances to control their home environments. The importance of an appropriate literacy level of the instrument and combining assessment with client education was passionately promoted.

The case study of New Brunswick public health nurses indicated that appropriate tools for assessing children's home environments were not in standard use, but were greatly needed. The participants recommended that future assessment tools be designed with an educational component built into the assessment tool. In addition, they recommended a two-step tool design: 1) a comprehensive observational checklist that could be filled in over a series of home visits; and 2) a client-friendly educational tool that can be completed with the family, identifying the environmental hazard, the rationale for including each hazard, and action steps to mitigate the hazard. They recommended that in addition to families with children, the assessment tool should be targeted to young couples who are living in their own homes, but do not yet have children. As well, expectant parents need to have access to a prenatal home assessment and the subsequent action steps to make their pregnancies as safe as possible for their unborn children.

The New-Brunswick focus group identified government and non-government agencies, and health professionals and associations which could contribute to network capacity aimed at facilitating healthy homes for children. Opportunities for collaboration among identified stakeholders included a public awareness and education strategy and forming partnerships with both inter-sectoral and inter-provincial organizations.

In addition to practical tools and resources needed by home visitors, the seven community nurses participating in the focus group stressed the need for evidence and best practices, public awareness and education and communication strategies as well as linking to other initiatives, such as the Built Environment Network.

### References

1. Leech JA, Nelson WC, Burnett RT, Aaron S, Raizenne ME. It's about time: a comparison of Canadian and American time-activity patterns. *J Expo Anal Environ Epidemiol*. 2002 Nov;12(6):427-32.
2. Paulson JA. The health effects of air pollution. Webinar: impact of air pollution on children's health. Washington, DC: Mid-Atlantic Centre for Children's Health and Environment (MACCHE); 2013 Dec 4.
3. Landrigan P, Etzel R, editors. Textbook of children's environmental health. Oxford, UK: Oxford University Press; 2014. Available from: <http://ukcatalogue.oup.com/product/9780199929573.do>.
4. Kim KH, Jahan SA, Kabir E. A review on human health perspective of air pollution with respect to allergies and asthma. *Environ Int*. 2013 Sep;59:41-52.
5. Murphy JS, Sandel M. The home environment. In: Landrigan P, Etzel R, editors. Textbook of children's environmental health. Oxford, UK: Oxford University Press; 2014. Available from: <http://ukcatalogue.oup.com/product/9780199929573.do>.
6. Needleman HL, Gunnoe C, Leviton A, Reed R, Peresie H, Maher C, et al. Deficits in psychologic and classroom performance of children with elevated dentine lead levels. *N Engl J Med*. 1979 Mar 29;300(13):689-95.
7. Rice DC. Behavioral effects of lead: commonalities between experimental and epidemiologic data. *Environ Health Perspect*. 1996 Apr;104 Suppl 2:337-51.
8. Mendell MJ, Mirer AG, Cheung K, Tong M, Douwes J. Respiratory and allergic health effects of dampness, mold, and dampness-related agents: a review of the epidemiologic evidence. *Environ Health Perspect*. 2011 Jun;119(6):748-56.
9. Tischer CG, Heinrich J. Exposure assessment of residential mould, fungi and microbial components in relation to children's health: achievements and challenges. *Int J Hyg Environ Health*. 2013 Mar;216(2):109-14.
10. Tong J, Qin L, Cao Y, Li J, Zhang J, Nie J, et al. Environmental radon exposure and childhood leukemia. *J Toxicol Environ Health B Crit Rev*. 2012;15(5):332-47.
11. Breyse PN, Diette GB, Matsui EC, Butz AM, Hansel NN, McCormack MC. Indoor air pollution and asthma in children. *Proc Am Thorac Soc*. 2010 May;7(2):102-6.
12. Heinrich J. Influence of indoor factors in dwellings on the development of childhood asthma. *Int J Hyg Environ Health*. 2011 Jan;214(1):1-25.
13. Kelly LA, Erwin EA, Platts-Mills TA. The indoor air and asthma: the role of cat allergens. *Curr Opin Pulm Med*. 2012 Jan;18(1):29-34.
14. U.S. Environmental Protection Agency. An introduction to indoor air quality (IAQ): Volatile Organic Compounds (VOCs). Washington, DC: EPA; 2013 [cited 2014 Jun 2]; Available from: <http://www.epa.gov/iaq/voc.html>.
15. Roda C, Kousignian I, Guihenneuc-Jouyaux C, Dassonville C, Nicolis I, Just J, et al. Formaldehyde exposure and lower respiratory infections in infants: findings from the PARIS cohort study. *Environ Health Perspect*. 2011 Nov;119(11):1653-8.
16. McGwin G, Lienert J, Kennedy JI. Formaldehyde exposure and asthma in children: a systematic review. *Environ Health Perspect*. 2010 Mar;118(3):313-7.

17. World Health Organization. WHO guidelines for indoor air quality: selected pollutants. Geneva, Switzerland: WHO; 2010. Available from: <http://www.euro.who.int/en/what-we-publish/abstracts/who-guidelines-for-indoor-air-quality-selected-pollutants>.
18. U.S. Environmental Protection Agency. Benzene. Washington, DC: EPA; [cited 2014 Jun 2]; Available from: <http://www.epa.gov/ttn/atw/hlthef/benzene.html>.
19. Le Cann P, Bonvallot N, Glorennec P, Deguen S, Goeury C, Le Bot B. Indoor environment and children's health: recent developments in chemical, biological, physical and social aspects. *Int J Hyg Environ Health*. 2011 Dec;215(1):1-18.
20. U.S. Environmental Protection Agency. America's children and the environment, 3rd Ed. Washington, DC: EPA; 2013. Available from: <http://www.epa.gov/ace/index.html>.

### APPENDIX 1: Literature Review Search Parameters

#### Search of the epidemiological literature on suspected and known indoor air contaminants for morbidity in children, early or later in life;

Recent reviews and primary studies in the epidemiological literature were searched using PubMed, Medscape, Science Direct and Google Scholar. Search terms included: air pollution, air contaminants; indoor, housing, home, home environment, residence characteristics, preconception care, fetus, pregnancy, child, infant, environmental health, environmental pollutants, environmental exposure, risk assessment and hypersensitivity.

From 447 citations dating back to 1972, only articles from 2010 to 2014 (inclusive) were filtered into the search. Filters included: 2010-2014: review; English; peer-reviewed; and full text. Additional filters were used when scanning these articles: peer reviewed; reviews; setting (home, household, housing); population (children); geography (North America); and whether they were available in full text. From these thirty citations, nine studies were deemed to be suitable for inclusion and were obtained from the University of New Brunswick library.

Using these nine studies as a starting point, additional studies were added to fill in any gaps in contaminants. A search of Medscape, Science Direct and Google Scholar resulted in additional studies, as did the references cited in a 2014 textbook on children's environmental health (Etzel and Landrigan, 2014). References in two excellent articles on lead exposure by Kelly O'Grady (2010) also produced further articles.

In total, fifteen articles on air contaminants and their health effects in children were selected for inclusion in the literature review.

#### Search for sample questionnaire checklists, observation forms and relevant measurement techniques.

- The sample tools being sought included questionnaires, checklists, observation forms and relevant measurement tools.

The search methodology consisted of a scoping search of the grey literature, using Google. Websites included Canadian and international government agencies (federal, provincial, municipal), non-government organizations (Canadian and international; many health-related, some environment-related), coalitions or partnerships and professional associations. Search terms included: children's environmental health, environmental health assessment, indoor air hazards, assessment tool, screening tool, questionnaire, survey, checklist, observational tool, measurement tool, healthy homes and asthma screening. Tools were selected on the basis of their relevance for use in Canadian homes, whether the source was reputable and whether the instrument was accessible. Six instruments fit these criteria, of thirty citations.

## APPENDIX 2: Summaries of Selected Studies on Children’s Environmental Health

### Summaries of Selected Studies on Air Contaminants and Children’s Environmental Health

#### *CATEGORY 1: BUILDING EXPOSURES RELATED TO INDOOR AIR CONTAMINANTS*

---

##### **Asbestos**

**Murphy, J. S. and Sandel, M. (2014).** The Home Environment. In: Textbook of Children’s Environmental Health. P. Landrigan and Etzel, R., Eds. New York: Oxford University Press, 125-126.

Asbestos, a group of naturally occurring fibrous minerals, was formerly used widely in construction, commonly as insulation. It was also used in ceiling and floor tiles and in textiles and coatings. Although now banned or strictly regulated, it is still found in older homes, where it poses a great potential danger if disturbed for renovations. Because mesothelioma, a rare form of cancer affecting the lining of the lungs, chest, heart and abdomen, is exclusively caused by cumulative low-dose exposures to asbestos, it is critical to prevent all asbestos exposure in childhood.

##### **Lead**

**Needleman, H.L. et al. (1979).** Deficits in Psychologic and Classroom Performance of Children with Elevated Dentine Lead Levels. *New England Journal of Medicine*. 300: (13), 689-695.

- This landmark study established the neurotoxic properties of lead at blood lead levels below those associated with obvious symptoms (usually described as lead intoxication). This study found an association with reduced IQ, auditory and speech processing, attention difficulties, and difficulties with most items in a teachers’ behavior rating scale.
- At the time of the study (1979), the Center for Disease Control had defined a blood lead level of 30 micrograms/deciliter as the “threshold for undue lead absorption”.
- The study’s call for a review of “permissible exposure levels” began a gradual reduction in the allowable blood lead levels to today’s recommended level of 5 micrograms per deciliter of lead in blood. (This value was adopted in 2012 by CDC).

**Rice, D.C. (1996).** Behavioural Effects of Lead: Commonalities between Experimental and Epidemiologic Data. *Environmental Health Perspectives*. 104 (S2), 337-351.

- This comprehensive study by a Canadian researcher with Health Canada, examined the congruence between experimental animal studies and epidemiological studies regarding the behavioural effects of lead. The commonalities identified included deficits in global functioning,

impaired spatial processing and increased distractability, inappropriate responding, perseveration, and inability to change response strategy.

**O’Grady, K.** (2011). Resolution 10: The Prevention of Childhood Lead Poisoning in Canada Occurring from Exposure to Lead-Based Paint and Other Domestic Sources of Lead. Submitted by the Registered Nurses Association of Ontario to the Canadian Nurses Association in 2011.

- This resolution provides a summary of the Canadian policy context regarding the need for regulations to protect Canadian children from exposure to lead paint found in older housing stock. It notes that evidence since 1990 has shown that it is the lead dust from deteriorating paint in older homes and renovating activities that is the primary source of chronic lead exposure for young children today.

**Rasmussen, P.E. et al.** (2011). Canadian House Dust Study: Lead Bioaccessibility and Speciation. *Environmental Science Technology*. 45(11), 4959-4965. (Accessed at: <http://pubs.acs.org/doi/ipdf/10.1021/es104056m> )

- This population-based study investigated concentrations of bioaccessible lead (Pb<sub>s</sub>) in settled house dust in 1,025 randomly selected urban Canadian homes. There was a trend toward increased Pb bioaccessibility, with higher Pb concentrations in the older homes located in central core areas of cities, compared to the 90% of homes in the “urban background”. This study provides a nationally representative urban baseline for applications in human health risk assessment and risk management.

### Radon

**Jian Tong, Qin, Yi Cao, Jianxiang Li, Jie Zhang, Jihua Nie, Yan An.** (2012). Environmental Radon Exposure and Childhood Leukemia. *Journal of Toxicology and Environmental Health, Part B*, 15:332–347.

- Radon exposure in homes has been linked to an increased risk of lung cancer in adults, but links with other types of cancers in children had not been consistently demonstrated. This review summarized data published thus far from ecological and case-controlled populations. Data indicated an association between environmental radon exposures and increased risk of childhood leukemia overall, as well as for acute lymphoblastic leukemia. More evidence is required before this can be confirmed with certainty.

### Polyvinyl Chloride (PVC)

**US Environmental Protection Agency.** 2013. *America’s Children and the Environment.*, Third Edition, 226-228.

- Polyvinyl chloride is the second most commonly used plastic in the world, being present in pipes and tubing, construction materials, packaging, electrical wiring and thousands of consumer products. Phthalates are used in the production of PVC. European research is reporting an increased risk of bronchial obstruction associated with the presence of PVC in the home.

**Murphy, J.S and Sandel, M.** 2014. The Home Environment. In: Textbook of Children's Environmental Health. Landrigan, P.J and Etzel, R.A., Eds. New York: Oxford University Press.

- These researchers report that PVC itself is inert, and does not pose a problem to the health of pregnant women and children. However, when PVC burns, it produces highly toxic dioxins and furans, associated with reproductive and developmental problems and an increased risk of cancer.

### **CATEGORY 2: AEROALLERGENS AND IRRITANTS**

---

#### **Dust mites, pests (cockroaches and rodents) and furry pets**

**Kelly, L.A., Erwin, E.A., Platts-Mills, T.A.E.** (2012). The Indoor Air and Asthma: the role of cat allergens. *Curr Opin Pulm Med* . 2012 January; 18(1): 29–34.

- Major sources of allergens in the indoor air include dust mite, cockroach and several fungi as well as dander from domestic animals and rodents. Cat allergen exposure is more complicated because the allergen particles are sticky and are transported to other locations, e.g., houses, schools and public buildings. Sensitization to the cat allergen, Fel d 1, is the most dominant response to inhaling cat dander. There is evidence that tolerance is associated with early exposure, but that the antibodies associated with it contribute to asthma severity. There is increasing evidence that antibodies associated with inhalant allergens such as Fel d 1, dust mite or cockroach, are causally related to lung inflammation and asthma.

#### **Dampness-related microbiologic agents**

**Mendell, M.J. et al.** (2011). Respiratory and Allergic Health Effects of Dampness, Mold, and Dampness-related Agents: A Review of the Epidemiologic Evidence. *Environmental Health Perspectives* (June) 119: 748-756.

- Mendell et al. evaluated literature reports for evidence of causation or association between qualitative or subjective assessments of dampness or mold and specific health outcomes. They also considered evidence for associations between specific quantitative measurements of microbiologic factors and each health outcome. Evident dampness or mold had consistent positive associations with multiple allergic and respiratory effects. Measured microbiologic agents in dust had limited suggestive associations, including both positive and negative associations for some agents. Although prevention and remediation of indoor dampness and mold are likely to reduce health risks, current evidence does not support measuring specific indoor microbiologic factors to guide health-protective actions.

**Tischer, C.G. and Heinrich, J. (2013).** Mini-Review: Exposure assessment of residential mould, fungi and microbial components in relation to children's health: Achievements and challenges. *International Journal of Hygiene and Environmental Health*. 216, 109-114.

- This review examines the impact of mould and microbial agents in the home in relation to respiratory health in children. There is still little known about the causal agents that impact allergic respiratory disorders in children, which is compounded by a lack of validated and standardized exposure assessment methods.
- Epidemiological studies on exposure to mould and bacterial-derived components revealed conflicting results, some reporting protective effects through stimulation of the immune system early in life, and others reporting harmful effects with the development and exacerbation of asthma.
- The authors suggest that in order to identify patterns of agents invoking harmful or protective effects on the development of asthma and allergic diseases, future studies need to focus on assessment and analysis techniques. They also suggested that exposure to mould and indoor contaminants during childhood might not only affect respiratory health, but also children's general health and development.

### Second Hand Smoke

**Heinrich, J. (2011).** Influence of indoor factors in dwellings on the development of childhood asthma. *International Journal of Hygiene and Environmental Health*. 214, 1-25.

- This strategic review summarizes current knowledge of the effects of a broad spectrum of indoor factors on the development of asthma in childhood in Western countries based on epidemiological studies. The most consistent finding for an induction of asthma in childhood is related to exposure to environmental tobacco smoke, to living in homes close to busy roads, and in damp homes where there are visible moulds.
- Environmental Tobacco Smoke\_(containing PM and a variety of toxic chemicals) is the most important indoor air pollutant and contains more than 4,000 chemicals which have known or suspected carcinogenic, mutagenic, toxic or inflammatory properties. The review concluded that there is sufficient evidence for a causal relationship between ETS and the onset of asthma in childhood.

### Particulate Matter

**Breyse, P.M., Diette, G.B., Matsui, E.C., Butz, A.M., Hansel, N.N. and McCormack, M.C. (2010).** Indoor Air Pollution and Asthma in Children. *Proceedings of the American Thoracic Society*. 7, 102–106.

- This article reviewed indoor air pollution factors that can modify asthma severity, particularly in inner-city environments. Particulate matter is a principal component of indoor air pollution in homes. Indoor sources include cigarette smoking, cooking, wood and other biomass burning in stoves and fireplaces, cleaning activities that re-suspend dust particles (e.g., sweeping), and penetration of outdoor particles into the indoor environment. Indoor PM differs from outdoor

## Environmental Health Risks in Children

---

PM in source, composition, and concentration. As a result, the health effects of indoor PM cannot be readily extrapolated from studies of outdoor air pollution.

- PM measured in the home (by means of a light-scattering nephelometer) was much higher and more variable than that occurring outside the home or at a monitoring site.
- The relatively few studies of indoor PM and asthma suggested that PM<sub>2.5</sub> exposure decreased pulmonary function in school-aged children, and also that PM<sub>2.5</sub> from indoor sources was more potent in decreasing lung function than was outdoor-derived PM. Fine PM was also positively associated with respiratory symptoms and with the use of rescue medications.
- Indoor coarse PM concentrations were associated with substantial increases in asthma symptoms.

**World Health Organization.** 2005. Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide: Global Update 2005, 8-10.

- Adverse health effects are evident at exposures to PM<sub>2.5</sub> and PM<sub>10</sub> that are currently experienced by urban populations, and susceptibility varies with age. There is a broad range of effects, but most are predominantly to the respiratory and cardiovascular systems. Adverse effects are shown with both short and long-term exposure.

### **CATEGORY 3: CHEMICAL EXPOSURES IN THE HOME**

---

#### **Volatile Organic Compounds (formaldehyde and benzene) and Semi-Volatile Organic Compounds (pesticides, phthalates and PBDEs)**

**Le Cann, P. et al.** (2011). Indoor environment and children's health: Recent developments in chemical, physical and social aspects. *International Journal of Hygiene and Environmental Health*. 215, 1-18.

- This comprehensive review takes a broad approach to indoor environments, and focuses on their impact on children's health – including chemical, microbial, physical and social aspects. It highlights new findings and discusses the interactions between agents in indoor environments, as well as social aspects. The article reviews and summarizes papers published between 2006 and 2010, and was focused on peer reviewed articles that investigated children's indoor environments with measurements of agents that may affect infants and children (respiratory effects, allergies, endocrine disruption, neurotoxicity, etc.)
- Chemical agents included were metals, volatile organic compounds (VOCs) such as formaldehyde or benzene and semi-volatile organic compounds (SVOCs) such as phthalates, pesticides and polybrominated diphenyl ethers (PBDEs). Most of the papers pertained to SVOCs. The type of compound, exposures and health effects are summarized below.

VOCs – Exposure: Better exposure assessment needed.

- Health Effects: association with asthma

**SVOCs** – Exposure: Importance of dietary contribution; significant role of indoor environments; children’s contamination (biomarkers) 3 to 5 times higher than adults. Health Effects: Positive trends between indoor phthalates exposure and asthma.

**Pesticides** – Exposure: Dermal contact is primary route with foggers use. Health Effects: Positive trends between indirect pesticide exposure and childhood cancer, and adverse birth outcomes.

### Volatile Organic Compounds

#### **Formaldehyde**

**Roda, C., Kousignian, I., Guihenneuc-Jouyaux, C., Dassonville, C., Nicolis, C., Just, J. and Momas, I.** (2011). Formaldehyde Exposure and Lower Respiratory Infections in Infants: Findings from the PARIS Cohort Study. *Environ Health Perspect* 119:1653-1658 (2011). <http://dx.doi.org/10.1289/ehp.1003222> [online 02 August 2011]

- Formaldehyde (FA) was measured in a random sample of 196 infants’ dwellings, and exposure to this pollutant was then estimated for 2,940 infants using predictive models based on measurements and data about potential determinants of FA levels. Findings suggest that infants exposed to FA at an early age have an increased incidence of Lower Respiratory Infections.

**McGwin, G, Lienert, J and Kennedy, J.I.** (2010). Formaldehyde Exposure and Asthma in Children: A Systematic Review. *Environ Health Perspect* 118 (3): 313-317.

- This systematic review examined seven peer-reviewed studies providing quantitative results which showed a significant positive association between formaldehyde exposure and asthma in children.

#### **Benzene**

**World Health Organization.** 2010. WHO Guidelines for Indoor Air Quality: selected pollutants, 15.

- Benzene is an aromatic compound that is clear, colourless, volatile, highly flammable and with a characteristic odour and density. Indoor air is a significant source of benzene exposure, and inhalation is the main exposure pathway. It is a genotoxic carcinogen in humans and there is no safe level of exposure. Reducing indoor air levels will require reducing or eliminating tobacco smoke, the use of solvents for hobbies or cleaning and the use of building materials that off-gas benzene. Diesel exhaust also contains benzene.

**US Environmental Protection Agency.** 2013. America’s Children and the Environment, Third Edition, 52, 342.

- A number of studies suggest that environmental contaminants may play a role in the development of childhood cancers, in particular, pesticides and solvents, such as benzene,

### SVOCs (Pesticides, Phthalates, PBDEs)

#### **Pesticides**

**Le Cann, P. et al.** (2011). Indoor environment and children’s health: Recent developments in chemical, physical and social aspects. *International Journal of Hygiene and Environmental Health.* 215, 1-18.

- No evidence was found in this review of peer-reviewed articles on children's indoor environments to suggest an association between exposure to pesticides and respiratory effects in children. However, the review did not evaluate the effects of pesticide sprays. It noted that some pesticides (organophosphorous, organochlorine or carbamates insecticides) are well-known neurotoxins. In addition, epidemiological studies have shown limited evidence supporting associations between pesticide exposure and cancer or adverse birth outcomes, but the results are inconsistent.

### ***Phthalates***

**Heinrich, J.** (2011). Influence of indoor factors in dwellings on the development of childhood asthma. *International Journal of Hygiene and Environmental Health*. 214, 1-25.

- A number of epidemiological studies in children up to 2007 showed positive associations between indicators of phthalate exposure at home and the risk of asthma, but the level of evidence was insufficient to infer the presence or absence of a causal relationship.

**US Environmental Protection Agency.** 2013. *America's Children and the Environment*, Third Edition, 227.

- Phthalate exposure in the homes may contribute to asthma and allergies in children. Two studies in Europe reported associations between phthalate exposure in surface dust in the home and increased risk of runny nose, eczema and asthma in children.

### ***PBDEs***

**US Environmental Protection Agency.** 2013. *America's Children and the Environment*, Third Edition, 227.

- Polybrominated diphenyl ethers are a group of flame retardants that are gradually being phased out in Europe and the United States, and replaced by alternatives, not yet assessed by EPA. PBDEs are not chemically bound to the products in which they are used, easily migrating to the surrounding air, dust, soil and water. Although production is being phased out, the chemicals will continue being released through the continued use of the products containing them. The important sources of exposure are primarily through dust and secondly, through food, including breastfeeding.
- Children tend to have greater exposure levels than adults. An Australian study found children aged 2 to 5 years had the greatest exposure levels, compared with older children and adults. Animal studies, and a limited number of epidemiological studies, have not shown a relationship with respiratory effects in children. However, there are concerns about effects on the developing brain and nervous system. As suspected endocrine disruptors, there are concerns about the potential for adverse effects on children's health, particularly adverse effects on reproduction, early and adolescent development and behavior.

### CATEGORY 4: GASES

---

#### NO<sub>2</sub>

**Breyse, P.M., Diette, G.B., Matsui, E.C., Butz, A.M., Hansel, N.N. and McCormack, M.C. (2010).** Indoor Air Pollution and Asthma in Children. *Proceedings of the American Thoracic Society*. 7, 102–106.

- This article reviewed indoor air pollution factors that can modify asthma severity, especially in inner-city environments. NO<sub>2</sub>, an irritant gas, is a product of high-temperature combustion. The main indoor source is unvented or improperly vented gas appliances such as stoves and furnaces. Higher NO<sub>2</sub> concentrations were associated with statistically significant increases in respiratory symptoms in preschool children with asthma, and with increasing frequency of limited speech due to wheezing, coughing without a cold and nocturnal awakenings due to cough, wheeze and shortness of breath. However, there was no association with rescue medication use in the previous two weeks or health care utilization.

#### General Indoor Air Pollution

**Misra, P., Srivastava, R., Krishnan, A., Sreenivaas, V. and Pandav, C.S. (2012).** Indoor Air Pollution-related Acute Lower Respiratory Infections and Low Birthweight: A Systematic Review. *Journal of Tropical Pediatrics*. 58 (6), 457-466.

- This systematic review sought to establish a quantitative association between acute lower respiratory infection (ALRI) and low birth weight (LBW) attributable to indoor air pollution in children under age 5. Meta-analysis showed that the risk of ALRI increased by 2.51 times, while the risk of LBW increased by 1.45 times due to exposure to indoor air pollution. This review confirms and strengthens the findings of previous reviews and provides further strong evidence of associations of both ALRI and LBW with indoor air pollution.

**Heinrich, J. (2011).** Influence of indoor factors in dwellings on the development of childhood asthma. *International Journal of Hygiene and Environmental Health*. 214, 1-25.

- This strategic review summarizes current knowledge of the effects of a broad spectrum of indoor factors on the development of asthma in childhood in Western countries based on epidemiological studies. The most consistent findings for an induction of asthma in childhood are related to exposure to environmental tobacco smoke, living in homes close to busy roads, and damp homes where there are visible moulds.

## APPENDIX 3: Exposure to Indoor Air Contaminants: Assessment Questionnaire (Prototype)

A draft questionnaire prototype to be delivered by public health home visitors to families with children  
Prepared for testing by a Focus Group of public health nurses and allied professionals

Fredericton, New Brunswick

February 25, 2014

### INTRODUCTION

This questionnaire is intended to be administered by public health home visitors to families with children. It focuses in particular on exposure to indoor air contaminants, i.e., contaminants related to the building itself, aero-allergens and irritants, chemical exposures in the home, radon and nitrogen dioxide. It describes the rationale for each question and sets out action steps.

Question	Answer	Rationale	Action Steps
<b>BUILDING EXPOSURES RELATED TO INDOOR AIR CONTAMINANTS</b>			
<b>Asbestos</b>			
<u>Sources:</u> Formerly used in old construction as insulation around boilers and pipes, in ceiling and floor tiles and in textiles and coatings. Poses health risks during renovation of older buildings.			
1. Has your home been tested for asbestos?	Y/N Not sure	Health risks during renovation, due to release of microscopic asbestos fibres into the air. Childhood exposure can lead to asbestosis, lung cancer and mesothelioma in adulthood.	Mitigation measures, if asbestos present. Report to appropriate housing authorities.
2. Was asbestos found?	Y/N Not sure		
3. If yes, has it been mitigated?	Y/N Not sure		
<b>Polyvinyl chloride (PVC)</b>			
<u>Sources:</u> vinyl siding and flooring, food packaging			
4. Does your home have: exterior PVC siding? Vinyl floors?	Y/N Not sure	PVC does not pose a hazard to pregnant women and children. But it can pose a hazard when it burns, releasing toxic chemicals.	Be aware when near open fires that some building materials and food packaging contain PVC and can release highly toxic chemicals which can cause reproductive and developmental problems and increase the risk of cancer.
5. Did you know that food packaging contains PVC?			

## Environmental Health Risks in Children

Question	Answer	Rationale	Action Steps
<p><b>Lead</b></p> <p><u>Sources:</u> Formerly used in in much higher concentrations in house paint; currently poses serious health risk to children under 6 living in older (pre-1978), deteriorated, lead-painted housing, especially during renovations. (Murphy, JS and Sandel, M, 2014).</p> <p><u>Allowable levels:</u> In both Canada and the US, the current allowable concentration of lead in residential paints is 90 ppm. In the US, a blood-lead level in a child above 5 µg per dL is an action level requiring further assessment. (O’Grady, 2011)</p>			
6. Was your house or apartment built before 1978?	Y/N Not sure	Buildings built before 1978 may contain lead paint. Lead can cause damage to the brain and neurological system; infants and children are especially sensitive.	If your home was built before 1978, it should be tested for lead.
7. Has your home been tested for lead?	Y/N Not sure	Lead poisoning can result in unusual symptoms that can’t be explained.	Maintain your home to prevent paint from chipping and peeling, which may release lead dust into the air.
8. Does your child have any unexplained symptoms such as difficulty sleeping, joint pain, headache, unusual behaviour, dizziness, irritability, weakness, fainting, staggering gait, convulsions or other?	Y/N Not sure		Take your child to the family doctor and inquire about blood testing for lead.

## Environmental Health Risks in Children

Question	Answer	Rationale	Action Steps
<b>Mould</b> <u>Sources:</u> This class of fungi grows on damp surfaces, including drywall and wood. Often found in areas with excess moisture such as kitchens, bathrooms and basements.			
9. Do you see or smell mould/mildew in your home?	Y/N Not sure	Can cause allergies. Mycotoxins are produced by mould, and can cause cough receptor irritation.	<ul style="list-style-type: none"> <li>- Open a window or turn on exhaust fan when there is excessive moisture in the room, such as when showering or cooking.</li> <li>- Scrub mould off hard surfaces with soap and water. Dry thoroughly.</li> <li>- Clean up mould and dry the surfaces completely when painting or caulking.</li> <li>- Replace absorbent materials, such as ceiling tiles and carpet, if mould is present.</li> </ul>
10. Is there evidence of water damage in your home?	Y/N Not sure	Water damage and high humidity can lead to mould growth.	<p>To avoid mould growth, maintain humidity at 30%-50%. (60% at most.)</p> <p>Dry affected items within 24-48 hours after water damage.</p> <p>Fix leaks.</p> <p>Replace materials where mould is present.</p> <p>If possible, use air conditioner or dehumidifier.</p>
<b>Radon</b> <u>Sources:</u> Underground sources as gas – odourless, tasteless and invisible. Can be present in well water.			
11. Has your home been tested for radon? (Ask to see the report)	Y/N Not sure	Radon is a leading cause of cancer.	Have your home tested for radon and undertake any repairs needed.
12. If radon detected, was remediation done?			

## Environmental Health Risks in Children

Question	Answer	Rationale	Action Steps
<p><b>Proximity to heavy traffic areas, industrial sites, landfills, hazardous waste sites</b></p> <p>Each of these hazards may exist near the family home, and health hazards such as diesel exhaust, lead, heavy metals, chemicals and pesticides may enter the home on footwear, clothing, etc.</p>			
13. Is your home near an industrial site, landfill, or a hazardous waste site?	Y/N		
14. Is your home near major highways or other high traffic roads?	Y/N		
<p><b>AERO-ALLERGENS AND IRRITANTS</b></p>			
<p><b>Second-hand smoke</b></p> <p><u>Sources:</u> The mixture of smoke from the burning end of a cigarette, pipe or cigar, and the smoke exhaled by a smoker. Found in the home or car.</p>			
15. Is smoking allowed in your home, car or workplace?	Y/N	Smoke contains chemicals that cause low birth weight and affect the developing brain and oxygen delivery system of the growing foetus. Second hand smoke is causally linked with Sudden Infant Death Syndrome, exacerbation of asthma in children, various ear problems and slowing of lung growth. (Samut, JM, 2014)	Make your home and car smoke free. Avoid smokers, as the smoke particles cling to clothing, which can be transported to the home.
<p><b>Dust mites</b></p> <p><u>Sources:</u> Highest levels found in bedding and mattresses. Also found in carpeting, curtains, upholstered furniture and stuffed toys.</p>			
16. Have you used any means for dust mite control? If so, which ones?	Y/N	Dust mites are a potent allergic trigger for some asthmatics.	Remove carpeting. Encase mattresses and pillows in allergy-proof covers. Keep humidity below 50% Damp dust and damp mop once or twice a week. Do not sweep.

## Environmental Health Risks in Children

Question	Answer	Rationale	Action Steps
<b>Pests</b> (such as cockroaches and rodents) <u>Source:</u> Often found in areas with food and water such as kitchens, bathrooms and basements.			
17. Do you see evidence of cockroaches or rodents in your home?	Y/N Not sure	Secretions and droppings are allergens.	Clean all surfaces where pests were seen. Use poison baits, boric acid or traps to kill pests. Limit the use of sprays and follow the instructions on the label.
<b>Furry Pets</b> <u>Source:</u> Throughout the house, if pets are allowed inside.			
18. Do you have pets? If yes, how many and what types?	Y/N	Skin flakes, urine and saliva are triggers for asthma and allergies. Pets carry home ticks and other pests.	Limit the number of pets in the household, or do not have pets.
<b>CHEMICAL EXPOSURES IN THE HOME</b>			
<b>Toxic Cleaning Products</b> <u>Source:</u> These are sold everywhere. In homes, they are usually stored in kitchen or bathroom cupboards, often within reach of young children.			
19. Do you use cleaning products such as bleach, drain cleaners and oven cleaners?	Y/N	Chemicals found in most commercial cleaning products can cause both acute and chronic toxicity, and death. (Murphy, JS and Sandel, M, 2014).	If these products are used, they should be stored out of children's reach.

## Environmental Health Risks in Children

Question	Answer	Rationale	Action Steps
<b>Ammonia</b>			
<u>Source:</u> Many cleaning products contain ammonia.			
20. Do you use cleaning products containing ammonia?	Y/N not sure	Exposures to high levels can cause burning of the eyes and upper respiratory tract. Lower levels can cause coughing, wheezing, shortness of breath, laryngitis, headaches, fever, nausea, vomiting, chest pain, pink frothy phlegm, asthma, rapid pulse and increased blood pressure. (Murphy, JS and Sandel, M, 2014).	Keep out of reach of children. Do not use ammonia-containing products when children are present. Switch to green cleaning products.
<b>Pesticides</b>			
Used to kill common pests in the home or yard (insects, rodents, weeds).			
21. Do you use pesticides?	Y/N	Pesticides can cause both acute and chronic toxicity in children. Prenatal exposure can cause injury to the developing brain and other organs. (Murphy, JS and Sandel, M, 2014).	Use an Integrated Pest Management approach, which minimizes the need for pesticides. (Source: EPA website)
22. In your home?	Y/N		
23. In your yard?	Y/N		
24. At work?	Y/N		
<b>Phthalates</b>			
Phthalates (e.g., BPA) are plastics chemicals found in many household items, e.g., shower curtains, blinds, toys, food packaging (lining of food cans), vinyl flooring and other building materials.			
25. Are you familiar with the effect of certain chemicals in plastics on human health?	Y/N	Exposures to phthalates, especially during pregnancy and in early neo-natal life, are linked to reproductive effects, and also to adverse effects on the development of the central nervous system. (Murphy, JS and Sandel, M, 2014).	Exposure reduction: (especially important for pregnant women and children): <ul style="list-style-type: none"> <li>- Reduce consumption of canned foods.</li> <li>- Reduce the use of plastic containers for storing beverages and food.</li> <li>- Reduce the use of fragranced creams and beauty products.</li> <li>- Choose products labelled "BPA-free".</li> </ul>

## Environmental Health Risks in Children

Question	Answer	Rationale	Action Steps
<p><b>Polybrominated diphenyl ethers (PBDEs) – Flame retardants</b></p> <p><u>Sources:</u> Breast milk (PBDEs are fat-soluble and can readily transfer and accumulate in breast milk); food, especially fish; inhalation and ingestion from indoor house dust (contaminated by shedding of PBDEs from computers, carpets, mattresses and other household furnishings).</p>			
26. Are you familiar with the effect of flame retardants on human health?	Y/N Not sure	Exposure of the developing foetus to PBDEs is reported to impair brain development and disrupt the normal function of hormones (affecting brain development, thyroid function, immune response, reproductive organs and other body systems).	Exposure reduction: (especially important for pregnant women and children) Avoidance of sources, by reducing consumption of fish closer to the top of the food chain; keeping the house free from dust; using mattress covers, or organic mattresses and bedding. Reduction in body burden is not as rapid as with BPA and others.
<p><b>Formaldehyde</b></p> <p><u>Source:</u> Formaldehyde is a Volatile Organic Compound (VOC), part of a diverse group of hydrocarbon compounds that have a low boiling point, evaporating readily at ambient temperatures – therefore contaminating both indoor and outdoor air. Formaldehyde is found in many household products, e.g., paints (latex), pressed wood products, fiberglass, permanent press fabrics, paper goods, fingernail polish, glue and new carpets.</p>			
27. Which of the above products can you find in your home?	None Some All	Formaldehyde is a human carcinogen. It can also trigger asthma, and cause irritation to the eyes, nose and throat. Exposure to high levels can cause a buildup of fluid in the lungs, shortness of breath and rapid heart rate.	Reducing exposure concentrations in indoor air: - Eliminate smoking in the home. - Minimize use of aerosols sprays. - Replace VOC containing furnishings (synthetic carpets, pressed wood furniture) with natural products. - more

## Environmental Health Risks in Children

---

Question	Answer	Rationale	Action Steps
<b>GASES</b>			
<b>Nitrogen Dioxide</b>			
<u>Source:</u> Gas stoves, wood stoves and fireplaces emit NO <sub>2</sub> .			
28. Do you use a gas stove, wood stove or fireplace?	Yes/No	Nitrogen Dioxide can produce respiratory irritation.	Make sure there is proper ventilation and that stoves have properly designed hoods.
<b>SOLVENTS</b>			
<b>Benzene</b>			
<u>Source:</u> cleaning products, cosmetics, nail polish remover, paints, adhesives, other household products and dry-cleaned clothes.			
29. To what extent do you use the above products?	Describe:	Benzene is an established cancer-causing agent.	Avoid using these products. If you do have clothing dry-cleaned, allow it to air outside before use.

## APPENDIX 4: Observational Assessment Tool

### *Exposure to Indoor Air Contaminants: Observational Assessment Tool*

Pediatric Environmental Home Assessment

National Center for Health Housing, 2006

Used for evaluation by a Focus Group of public health nurses and allied professionals

Fredericton, New Brunswick

February 25, 2014

#### **RESIDENT REPORTED INFORMATION - *Bolded responses indicate areas of greater concern***

General Housing Characteristics					
<b>Type of ownership</b>		<input type="checkbox"/> Own house	<input type="checkbox"/> Market rate rental hsg.	<input type="checkbox"/> Subsidized rental hsg.	<input type="checkbox"/> Shelter
<b>Age of home</b>		<input type="checkbox"/> <b>Pre-1950</b>	<input type="checkbox"/> <b>1950 - 1978</b>	<input type="checkbox"/> Post-1978	<input type="checkbox"/> <b>Don't know</b>
<b>Structural foundation</b>		<input type="checkbox"/> Basement	<input type="checkbox"/> Slab on grade	<input type="checkbox"/> Crawlspace	<input type="checkbox"/> Don't know
<b>Floors lived in (check all that apply)</b>		<input type="checkbox"/> Basement	<input type="checkbox"/> 1st	<input type="checkbox"/> 2nd	<input type="checkbox"/> 3 <sup>rd</sup> or higher
<b>Heating</b>	<b>Fuel used</b>	<input type="checkbox"/> Natural gas	<input type="checkbox"/> Oil	<input type="checkbox"/> Electric	<input type="checkbox"/> Wood
	<b>Sources in home</b>	<input type="checkbox"/> Baseboards	<input type="checkbox"/> Radiators	<input type="checkbox"/> Forced hot air vents	<input type="checkbox"/> <b>Other:</b>
	<b>Filters changed</b>	<input type="checkbox"/> Yes	<input type="checkbox"/> <b>No</b>	<input type="checkbox"/> HEPA air filter	<input type="checkbox"/> <b>Don't know</b>
	<b>Control</b>	<input type="checkbox"/> Easy to control heat	<input type="checkbox"/> Hard to control heat		
<b>Cooling</b>		<input type="checkbox"/> Windows	<input type="checkbox"/> Central/window AC	<input type="checkbox"/> Fans	<input type="checkbox"/> None
<b>Ventilation (check all that apply)</b>		<input type="checkbox"/> Open windows	<input type="checkbox"/> Kitchen & bathroom fans	<input type="checkbox"/> Central ventilation	

## Environmental Health Risks in Children

Indoor Pollutants					
<b>Mold and moisture</b>		<input type="checkbox"/> Uses dehumidifier <input type="checkbox"/> No damage	<input type="checkbox"/> Uses vaporizer or humidifier	<input type="checkbox"/> Musty odor evident	<input type="checkbox"/> Visible water / mold damage
<b>Pet</b>	<b>Presence</b>	<input type="checkbox"/> No pets	<input type="checkbox"/> Cat # _____	<input type="checkbox"/> Dog # _____	<input type="checkbox"/> Other: _____
	<b>Management</b>	<input type="checkbox"/> Kept strictly outdoors	<input type="checkbox"/> Not allowed in patient's bedroom	<input type="checkbox"/> Full access in home	<input type="checkbox"/> Sleeping location: _____
<b>Pests</b>	<b>Cockroaches</b>	<input type="checkbox"/> None	<input type="checkbox"/> Family reports	<input type="checkbox"/> Family shows evidence	Present in <input type="checkbox"/> kitchen <input type="checkbox"/> bedroom <input type="checkbox"/> other
	<b>Mice</b>	<input type="checkbox"/> None	<input type="checkbox"/> Family reports	<input type="checkbox"/> Family shows evidence	Present in <input type="checkbox"/> kitchen <input type="checkbox"/> bedroom <input type="checkbox"/> other
	<b>Rats</b>	<input type="checkbox"/> None	<input type="checkbox"/> Family reports	<input type="checkbox"/> Family shows evidence	Present in <input type="checkbox"/> kitchen <input type="checkbox"/> bedroom <input type="checkbox"/> other
	<b>Bedbugs</b>	<input type="checkbox"/> None	<input type="checkbox"/> Family reports	<input type="checkbox"/> Family shows evidence	Present in <input type="checkbox"/> bedroom <input type="checkbox"/> other
<b>Lead paint hazards</b>		<input type="checkbox"/> Tested and passed	<input type="checkbox"/> Tested, failed, and mitigated	<input type="checkbox"/> Not tested/Don't know	<input type="checkbox"/> Loose, peeling, or chipping, paint
<b>Asbestos</b>		<input type="checkbox"/> Tested – None present	<input type="checkbox"/> Tested, failed, and mitigated	<input type="checkbox"/> Not tested/Don't know	<input type="checkbox"/> Damaged material
<b>Radon</b>		<input type="checkbox"/> Tested and passed	<input type="checkbox"/> Tested, failed, and mitigated	<input type="checkbox"/> Not tested/Don't know	<input type="checkbox"/> Failed test but not mitigated
<b>Health and Safety Alarms</b>		<input type="checkbox"/> Smoke alarm working and well placed	<input type="checkbox"/> CO alarm working and one on each floor	<input type="checkbox"/> CO alarm does not log peak level	<input type="checkbox"/> No smoke alarm <input type="checkbox"/> No CO alarm
<b>Tobacco smoke exposure</b>		<input type="checkbox"/> No smoking allowed	<input type="checkbox"/> Smoking only allowed outdoors	<input type="checkbox"/> Smoking allowed indoors <input type="checkbox"/> bedroom <input type="checkbox"/> playroom	<input type="checkbox"/> Total # smokers in household: _____ <input type="checkbox"/> Mother smokes
<b>Other irritants</b>		<input type="checkbox"/> None	<input type="checkbox"/> Air fresheners	<input type="checkbox"/> Potpourri, incense, candles	<input type="checkbox"/> Other strong odors:
<b>Type of cleaning</b>		<input type="checkbox"/> Vacuum (non-HEPA)	<input type="checkbox"/> HEPA vacuum	<input type="checkbox"/> Damp mop and damp dusting	<input type="checkbox"/> Sweep or dry mop

NOTES:

## Environmental Health Risks in Children

**NURSE OBSERVED INFORMATION - *Bolded* responses indicate areas of greater concern**

Home Environment					
Drinking Water Source		<input type="checkbox"/> Public water system	<input type="checkbox"/> Household Well		
Kitchen	Cleanliness	<input type="checkbox"/> No soiling	<input type="checkbox"/> Trash or garbage sealed	<input type="checkbox"/> Trash or garbage not sealed	<input type="checkbox"/> Wall/ceiling/floor damage
	Ventilation	<input type="checkbox"/> Functioning stove exhaust fan/vent	<input type="checkbox"/> Mold growth present	<input type="checkbox"/> Broken stove exhaust fan/vent	<input type="checkbox"/> No stove exhaust fan/vent
Bathroom		<input type="checkbox"/> Functioning exhaust fan/vent/window	<input type="checkbox"/> Mold growth present	<input type="checkbox"/> Needs cleaning and maintenance	<input type="checkbox"/> Wall/ceiling/floor damage
Basement		<input type="checkbox"/> None/No Access	<input type="checkbox"/> Mold growth present	<input type="checkbox"/> Needs cleaning and maintenance	<input type="checkbox"/> Wall/ceiling/floor damage
Living Room		<input type="checkbox"/> No soiling	<input type="checkbox"/> Mold growth present	<input type="checkbox"/> Needs cleaning and maintenance	<input type="checkbox"/> Wall/ceiling/floor damage
Laundry area		<input type="checkbox"/> None	<input type="checkbox"/> Well maintained	<input type="checkbox"/> Dryer not vented	<input type="checkbox"/> Hang clothes to dry

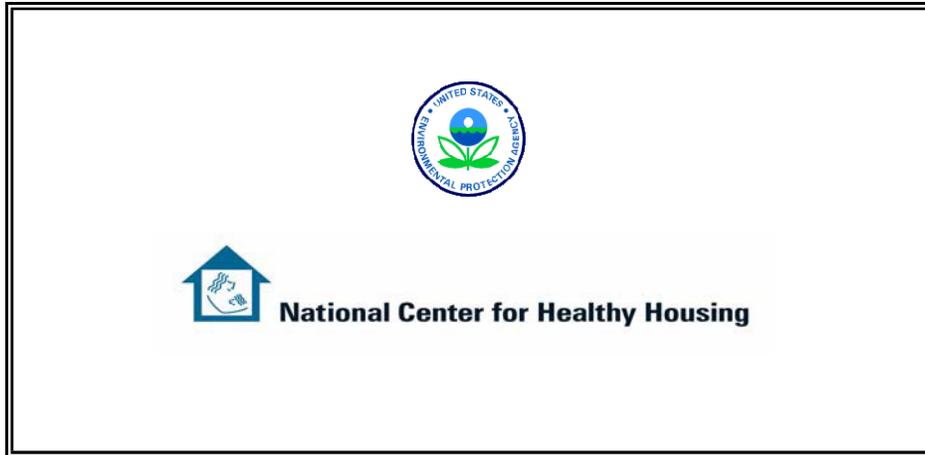
Sleep Environment					
Patient's sleep area		<input type="checkbox"/> Own room	<input type="checkbox"/> Shared # in room _____	<input type="checkbox"/> Other	
# Beds		<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> More than 2
Allergenimpermeable encasings on beds		<input type="checkbox"/> On mattress and boxspring (zippered)	<input type="checkbox"/> On mattress only (zippered)	<input type="checkbox"/> On mattress (not zippered)	<input type="checkbox"/> No mattress covers
Pillows		<input type="checkbox"/> Allergen-proof	<input type="checkbox"/> Washable	<input type="checkbox"/> Feather/ down	
Bedding		<input type="checkbox"/> Washable	<input type="checkbox"/> Wool/not washable	<input type="checkbox"/> Feather/ down	
Flooring		<input type="checkbox"/> Hardwood/ Tile/Linoleum	<input type="checkbox"/> Small area rug	<input type="checkbox"/> Large area rug	<input type="checkbox"/> Wall-to-wall carpet
Dust/mold catchers		<input type="checkbox"/> Stuffed animals/washable toys <input type="checkbox"/> No clutter	<input type="checkbox"/> Non-washable toys	<input type="checkbox"/> Plants	<input type="checkbox"/> Other _____
Window		<input type="checkbox"/> Washable shades/curtains	<input type="checkbox"/> Washable blinds	<input type="checkbox"/> Curtains/ drapes	<input type="checkbox"/> No window/ poor ventilation
Other irritants		<input type="checkbox"/> Abundant cosmetics and fragrances			

## Environmental Health Risks in Children

Home Safety				
* can indicate housing code violations				
<i>General</i>				
Active renovation or remodeling	<input type="checkbox"/> Yes	<input type="checkbox"/> No		
*Stairs, protective walls, railings, porches	<input type="checkbox"/> Yes	<input type="checkbox"/> No		
*Hallway lighting	<input type="checkbox"/> Adequate	<input type="checkbox"/> Inadequate		
Poison control number	<input type="checkbox"/> Posted by phone	<input type="checkbox"/> Not posted by phone		
**Family fire escape plan	<input type="checkbox"/> Developed and have copy available	<input type="checkbox"/> None		
Electrical appliances (radio, hair dryer, space heater)	<input type="checkbox"/> Not used near water	<input type="checkbox"/> Used near water		
Matches and lighters stored	<input type="checkbox"/> Out of child's reach	<input type="checkbox"/> Within child's reach		
Exterior environment	<input type="checkbox"/> Well maintained	<input type="checkbox"/> Abundant trash and debris	<input type="checkbox"/> Chipping, peeling paint	<input type="checkbox"/> Broken window(s)

<i>Young Children Present</i>	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
Coffee, hot liquids, and foods	<input type="checkbox"/> Out of child's reach	<input type="checkbox"/> Within child's reach	
Cleaning supplies stored	<input type="checkbox"/> Out of child's reach	<input type="checkbox"/> Within child's reach	
Medicine and vitamins stored	<input type="checkbox"/> Out of child's reach	<input type="checkbox"/> Within child's reach	
Child (less than six years old) been tested for lead poisoning	<input type="checkbox"/> Within past 6 months Result: _____	<input type="checkbox"/> Within past year or more. When? _____ Result: _____	<input type="checkbox"/> No
Child watched by an adult while in the tub	<input type="checkbox"/> Always	<input type="checkbox"/> Most of the time	<input type="checkbox"/> No
*Home's hot water temperature	<input type="checkbox"/> <120 F	<input type="checkbox"/> >120 F	<input type="checkbox"/> Don't know
Non-accordion toddler gates used	<input type="checkbox"/> At top of stairs	<input type="checkbox"/> At bottom of stairs	<input type="checkbox"/> No
Crib mattress	<input type="checkbox"/> Fits well	<input type="checkbox"/> Loose	<input type="checkbox"/> NA
Window guards	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
Window blind cords	<input type="checkbox"/> Split cord	<input type="checkbox"/> Looped cord	

NOTES:



Funded by The U.S. Environmental Protection Agency

and developed by

10227 Wincopin Circle

Suite 200 • Columbia, MD 21044 •

Tel. (410) 992-0712

[www.centerforhealthyhousing.org](http://www.centerforhealthyhousing.org)

With thanks to

**N • E • E • T • F**

The National Environmental Education & Training Foundation

We credit its Environmental Management of Pediatric Asthma: Guidelines for Health Care Providers

and model Pediatric Environmental History Form

and



The Center for Healthy Homes and Neighborhoods at Boston University

We credit its model Pediatric Asthma-Allergy Home Assessment form

### APPENDIX 5: Notes from the Focus Group Consultation

The consultation proceeded in two sections:

- Part One: Assessing the Tools
- Part Two: Considering Collaborations, Communications and Supports needed to integrate new Environmental Health Home Assessment tools into public health practice.

#### *PART ONE: Assessing the Tools*

---

##### **1. Draft Questionnaire (Prototype Tool)**

This tool, consisting of selected tool elements drafted by the consultant, was distributed to the participants in advance. The elements were directed at assessing for the presence, sources and extent of suspected and known indoor air environmental health hazards that can cause morbidity in children, early or later in life.

The draft Questionnaire was ranked on a five-point scale, with 1 being 'not at all', and 5 being 'Excellent'.

##### **How well does the questionnaire rank with respect to:**

- Relevance to your work?           Somewhat = 3; Excellent = 4
- Ease of application?               Neutral = 3; Somewhat = 4
- Comprehensiveness?               Neutral = 1; Excellent = 6

##### **What are the gaps?**

- Literacy level was not appropriate for many client families; If we are to present the questionnaire to the client, the literacy level would need to be adapted.
- Questions often were directed to the "presence" of a certain contaminant, and often the "source", but not usually the "extent" of the contaminant.
- Translation to French is needed.
- A number of the questions were outside the client's control, making it of questionable value to ask them; more appropriate to ask the owner/landlord, or report to appropriate authorities.

##### **Comments on the Questionnaire:**

- The guiding principle should be to minimize the risks to the children in the home, and making sure that the remedial measures needed are within the family's control (with home visitor's support, when needed).
- The UN Convention on the Rights of the Child calls for healthy environments for children.

- The literacy level would need to be adapted to the families' level. New Brunswick's low literacy level is an issue in general. The participants did provide some alternative language for some items, e.g., Instead of "Do you see or smell mildew or mould in your home?" you could ask, "Do you ever notice a musty smell in your home?"
- Formatting - too long, not as user-friendly; maybe another format would be easier to comprehend for both the nurse and client; the nurse would need to get familiarized with the format before administering the screening.
- This questionnaire prototype included a section on Rationale (why certain questions were included). The consensus was that this was very important.
- I find the information provided in the rationale and action steps columns is quite interesting. The parents are always looking for solutions!
- very good educational tool
- *Asbestos*: The year when asbestos was taken out of insulation should be included.
- *Asbestos and lead*: With contaminants such as asbestos and lead, they asked, "Where do we draw the line between what is our role and what is an inspector's role?"
- *Lead*: Gap: need to include information on lead in jewelry, lunch bags, toys, trinkets, etc. Some frustration was expressed regarding the gap in regulation and policy, and how policy changes were needed, and protocols put in place. For example, if there were obvious chipping lead paint in an older home, who would they refer that observation to?
- *Mould*: they commented again on the literacy level, and also they would like to include in the Action Steps the name of a product that would be safe to use for killing mould spores.
- *Second hand smoke*: The questionnaire should identify the specific substance being smoked – tobacco, marijuana, sweet grass, flavoured marijuana in the hookah pipe, etc. There needs to be more education on "third-hand smoke", i.e., the smoking residues that cling to clothing, furnishings, etc. ("If you smell smoke, you are breathing in smoke.") The participants also agreed that
- *Dust mites*: Less conversation came up on this topic. It was noted that many low rental units have carpeting, and the families cannot usually afford a vacuum.
- *Pests and Pesticides*: Participants suggested that "lice" be added. The participants questioned the inclusion of poison baits to kill pests, suggested instead pesticide free treatments, natural products.
- *Furry pets*: Besides damp-dusting, damp-mopping and limiting the number of pets, the participants had no other comments, other than "What can you do – we all love our pets."
- *Toxic Cleaning Products*: These are far more expensive than non-toxic alternatives, and can cause lung irritation and other symptoms. The participants felt this was a good opportunity to

promote green (inexpensive) products in the home. Also, when non-toxic cleaning products are used, the children can be encouraged to help with the cleaning.

- *Phthalates*: General agreement on this section. More emphasis needs to be placed on fragrances in consumer products - air fresheners, personal care products, cleaners, etc.
- *Ammonia*: Participants indicated they themselves weren't sure which products contained ammonia. The knowledge content needs to be enhanced and translated into layman's terms.
- *Formaldehyde*: This section looked good.
- The sections on PBDEs, PVC, Solvents and Nitrogen Oxide need to be included.

### 2. Sample Observational Tool (the Pediatric Environmental Home Assessment)

This tool was ranked on a five-point scale, with 1 being 'not at all', and 5 being 'excellent'.

- Relevance to your work?            Neutral = 1; Somewhat = 3; Excellent = 3
- Ease of application?                Neutral = 2; Somewhat = 1; Excellent = 4
- Comprehensiveness?                Somewhat = 3; Excellent = 4

#### Gaps:

- The presence of lice was missing.
- Under heating, heat pumps should be added – showing up in newer apts.
- They talk about the storage of cleaning products but not their toxicity. They also omit pesticides, phthalates, ammonia, formaldehyde, etc. They don't mention the proximity to heavy traffic areas, industrial sites, landfills, hazardous waste sites, etc.

#### Comments on the Observational Tool:

- Several commented that they liked the injury prevention component being woven into the tool.
- I think the sections on Sleep environment and home safety are very important in our work.
- Liked the check boxes, liked the progression from "most safe" to "most hazardous" (left to right).
- Felt it was a comprehensive tool, and easy to use by home visitors.
- Most felt it would be best administered over a series of visits, with the paperwork being completed after returning to the office.
- The format is more user-friendly with only a checkmark to enter.
- It is more of a screening tool, the solutions aren't provided.

- One commented, “Not sure if I would feel comfortable just asking all these things without some type of teaching tool to go with it”. For example, the *Hidden Dangers in your Baby’s Nursery* (an info-graphic) – it is divided off into rooms and is very colourful”.  
<http://healthychild.org/hidden-dangers-in-your-babys-nursery>

### General discussion of tools:

- Consensus that the goal of any environmental home assessment tool is to address social determinants of health and respect the right of the child for conditions that support health (UN Convention on the Rights of the Child).
- There was consensus that the assessment could be best accomplished using a two-pronged approach – 1) having a comprehensive observational checklist that could be filled in over time, after leaving the home; and 2) having a colourful info-graphic that incorporated both environmental and safety hazards that could be used as a teaching tool within the home. This was described to be the “optimal tool” for use with at risk families.
- The importance of making the tool client-friendly and educational cannot be overstated. All the nurses were passionate about this aspect.
- Consensus that the home assessment should include a section on safety hazards in the home.
- The question was asked: “When is it a screening tool and when is it an educational tool?”
- There should be tools to use prenatally as well.
- Re: The sample tools that were sent out in advance of the focus group:
  - One of their favourite tools was the “Environmental Exposure Assessment” by Katie Huffling (a tool for women of child bearing age –prenatal and pre-conception) © 2011.
    - The colourful, user-friendly format
    - The section “Why do we ask this question?” which is an opportunity to educate while administering the tool.
    - The section “Steps to Reduce Risks”. The nurses felt that every question asked should include action steps.
    - They appreciated the accessibility of the language, e.g., “If you smell smoke it means you are breathing in smoke.”
- “A good assessment tool can be used as documentation – as evidence of the need for interventions; and also as an advocacy tool (data).”
- There was a discussion surrounding the utility of questions asked of the family – if there are no prevention strategies or solutions available (as when the issue is outside of the family’s control, or there is no person or agency that the nurses can refer to for assistance), then asking the question is not useful.

## Environmental Health Risks in Children

---

- Re: prevention and remediation: They would like to see sections for those things that are in the family's control, things that would be the landlord's responsibility and action steps that the nurses could take.

### Gaps in both tools presented:

- In New Brunswick, translation of tools to French is essential.
- There was concern around the lack of testing for blood lead levels in Canada, as compared to the USA.
- The participants pointed out a need for recommendations for toxic-free products to eliminate pests – lice, rodents, insects.
- Participants felt there should be a healthy homes tool for couples at the pre-conception and prenatal stages, as well.

There were two educational tools already in use by two of the participants:

- the “Creating Healthy Environments for Kids” series of pamphlets from the Canadian Partnership for Children's Health and the Environment.  
<http://www.healthyenvironmentforkids.ca/resources/creating-healthy-environments-kids>
- “Hidden Dangers in your Baby's Nursery” by Healthy Child Healthy World.  
<http://healthychild.org/hidden-dangers-in-your-babys-nursery/>

The two nurses shared the tools with others in the focus group, who agreed that they were excellent tools, and identified the main advantages of the tools:

- They are excellent teaching tools, presenting information in an engaging way – colourful, simple, straightforward.
- They do not intimidate their families.
- They are accessible and easy to understand, and make conversations with families easier on these topics.

### ***PART TWO: Collaborations, communications and supports needed to integrate new environmental health home assessment tools into public health practice.***

---

The following represents the flipchart notes taken during the focus group.

#### **A. Stakeholders**

- Department of Health, the Office of the Chief Medical Officer of Health
- Department of Social Development (Housing)
- Department of Healthy and Inclusive Communities
- Rentalsman

- New Brunswick Lung Association
- Department of Environment and Local Government
- Department of Education and Early Child Development
- Physicians, e.g., Tanya Wood of Boiestown
- New Brunswick College of Family Physicians
- New Brunswick Medical Society
- Practising nurses
- New Brunswick Nurses Association
- Nurse Practitioners (Kate Burkenholder)
- Pre-natal care providers
- Office of the Child and Youth Advocate

### **Thinking of prevention aspects:**

- For better building construction, need Engineers and City and Rural Planners
- Architects
- Al Gore Messenger, Carl Duivenvoorden
- Military (there are major housing concerns on the military base at CFB Gagetown)
- Federal agencies
- First Nations, locally and at federal level
- Regional Health Authorities (esp. Healthy Learners in Schools Program)
- City of Fredericton and other health-aware municipalities; all municipalities

### **B. Current level of collaboration and communication among stakeholders**

- Needs improvement (understatement!)
- The New Brunswick Lung Association has an annual symposium of multi-stakeholders.

### **C. What needs to happen to improve collaboration and communication among stakeholders within NB?**

#### **Guiding Principles**

- Whatever is put forward to our stakeholders has to have relevance to their mandates.
- Healthy Homes are our collective mandate.
- A Healthy Home is a child's right.

### Points made by the focus group:

- Loving Care booklets from the Department of Health need to include environmental aspects.  
<http://www2.gnb.ca/content/dam/gnb/Departments/h-s/pdf/en/HealthyPeople/LovingCare1to3Years.pdf>

Cited as: Parent Health Education Resource Working Group. Loving Care: 1 to 3 Years. [Halifax]: Nova Scotia Department of Health and Wellness, 2012; reprint [Fredericton]: Province of New Brunswick, 2013.

- Parental engagement (through education)
- Youth engagement (through school involvement)
- Engage the NB Children's Environmental Health Collaborative.
- Main message to stakeholders: "Healthy Homes are our collective mandate".
- Public awareness and education strategy (recall the introduction of our smoke-free legislation).
- We will need a communication strategy.
- This is not just an issue for nurses to address, this is a child rights issue.
- We need working groups.
- Leadership
- Conferences
- We need to tap into the Build Environment Network that is just forming.

### D. Tools and Resources needed to facilitate the broad adoption of measures to improve the health of children within their homes

- Practical tools for home visitors to use with families, e.g., infographics
- Need evidence and best practices!
- Social networking
- Partnerships, e.g., with the development of educational materials
- Inter-sectoral Healthy Homes Strategy for New Brunswick
- Link with the Poverty Reduction Strategy
- Influence public policy.

### E. Intra-provincial:

#### Existing mechanisms that could facilitate collaboration

- Nurses Association of New Brunswick – position statement
- NB Medical Society – in-service, position statement

- Joint Health and Safety Committees (There are four regional committees affiliated with WorkSafe NB, working toward healthier and safer workplaces.)
- Peri-Natal Support Group (Mary Lou Batty)

### F. Interprovincial:

#### **Mechanisms/Stakeholders that could be put in place:**

- Social media
- Family Physician conferences
- Conferences of other health professional groups
- Intersectoral Conferences – such as People Matter, a national conference sponsored by the Canadian Institute of Planners, and being held this year in Fredericton. The Nurses' Team of the NB Children's Environmental Health Collaborative have been accepted to do a presentation at the conference.
- NB Children's Environmental Health Collaborative – list serve and conferences
- Canadian Medical Officers of Health meet together (PHAC)
- Canadian Association of Schools of Nursing – very active, possible partnership
- National Collaborating Centre for Environmental Health
- Canadian Nurses for Health and the Environment (their newsletter; promote them at staff meetings.)
- Canadian Nurses Association
- Université de Moncton
- National Interest Group of Nurse Practitioners
- NB-PEI Public Health Association
- CLASP project – creating built environments to reduce chronic disease