Content Validity of a Questionnaire Specifically Designed to Clinically Identify Pediatric Environmental Exposures

by

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Abstract

Various clinical questionnaires exist to assist clinicians with the diagnosis, prognosis, long-term follow up of a disease, or even to assess quality of life. However, any questionnaire must be evaluated for its validity and reliability before application. Invalid or unreliable questionnaires can lead to bias or outcome misinterpretations. The Pediatric Environmental Health History (PEHH) questionnaire developed for clinical use is no exception and underwent a fundamental validation step, content validity. For the first phase, a modified Delphi technique was used to collect expert consensus for the original PEHH (200 questions spanning 9 sections). Experts were identified throughout the **P**ediatric **E**nvironmental **H**ealth **S**pecialty **U**nits (**PEHSUs**) network and the World Health Organization (WHO). Percent Agreement (PA) is an average percent of *experts* rating an individual question as relevant (e.g. "agree") per section. A PA of 90% was used as a criterion for the number of rounds required. After two rounds, excellent expert consensus for question relevancy was achieved for the nine domains indicated by a PA greater than 90%. Experts indicated agreement with the comprehensiveness of each PEHH section. A final version was generated based on the expert suggestions, consisting of 161 refined questions. In the second phase of the study, parents/guardians assessed PEHH usability through examining ease of answering questions, comprehension, and respondent burden. Pediatricians assessed PEHH usefulness for the clinical setting. After PEHH completion, 44 parents/guardians indicated good usability for all of the survey questions and were satisfied with the length and time taken to complete it. Upon

PEHH review, 15 pediatricians indicated good usefulness, but were dissatisfied with its length and anticipated administration time suggesting need for a shorter version. Through these study phases, content validity for the PEHH has been established ensuring an evaluation of question/item relevancy and comprehensiveness, and usability and usefulness. A relevant and comprehensive set of questions to clinically explore environmental risk factors for the pediatric population is available for future data collection, which can undergo further validation (e.g. construct validity).

Preface

This thesis is an original work by Parneet Jaggi. The research project, of which this thesis is a part, received research ethics approval from the University of Alberta Research Ethics Board, "Validation of a clinical questionnaire specifically designed for the identification of environmental risk factors", Pro00031023, 7/6/2012.

Dedication

"Family isn't always blood. It's the people in your life who want you in theirs; the ones who accept you for who you are. The ones who would do anything to see you smile & who love you no matter what…" –Unknown

I dedicate this thesis to all of the individuals in my life that believed in me, stood by my side, and helped me grow; to my grandfather Kesar Singh Jaggi, who believes that education is the greatest investment and always put his hand on my head to praise my achievements; to my mother and father for their endless prayers, encouragement, belief, patience, and understanding; to my brothers Aman and Lovey for always being a good distraction from studying; to my sister Ria for always managing to put a smile on my face when I need it most; to my friends Zafira and Priya for listening to me vent my frustrations and for lending a comforting shoulder during my toughest times, and lastly, to someone special who has always been supportive, told me to relax and that it would all work out okay. Thank you.

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List of Abbreviations

PEHH – **P**ediatric **E**nvironmental **H**ealth **H**istory

WHO – **W**orld **H**ealth **O**rganization

COSMIN - **CO**nsensus-based **S**tandards for the **S**election of health **M**easurement **IN**struments

PEHSU – **P**ediatric **E**nvironmental **H**ealth **S**pecialty **U**nit

REDCap – **R**esearch **E**lectronic **D**ata **Cap**ture

Introduction

Children's Environmental Health: A Global Perspective

Children's environmental health is a growing discipline, as evidence is emerging about environmental exposures and their effects on child health. In contrast to adults, children pose unique vulnerabilities to environmental exposures including physical, chemical, biological, and even social threats[1]. Children in general ingest more food, drink more water, and breathe more air as a proportion of their body weight compared to adults and their frequent hand to mouth activities also places them at higher risk to exposures[1]. Further, they are open to several 'windows of susceptibility' throughout their development due to their immature metabolic pathways, which result in different absorption, distribution, metabolism, and excretion mechanisms[1]. Certain differences in their metabolic patterns may however, offer them protection, such as dealing with toxicants like paracetamol[1]. Despite this, children are commonly found to deal with toxic chemicals less effectively compared to adults[1]. Their 'windows of susceptibility' can therefore result in disruptions to their development by various environmental factors, and further lead to the onset of diseases into adulthood[1].

Chronic effects due to environmental hazards are often initially identified in the clinical setting. Cumulated experience from the Children's Environmental Health Clinic at the Edmonton Misericordia Hospital has identified asthma and neurodevelopmental disorders as the most commonly encountered cases, which according to Garbutt *et al*. (2012) are also amongst the top health concerns for parents within their respective community[2] (Figure 1). The Study of Asthma and Allergies in Childhood found that although *international variations* in the prevalence of asthma have decreased, the global burden is still of concern due to the continual rise of its' prevalence[3]. This increase in prevalence and increasing parental concern has led to more attention to the role of indoor and outdoor air pollution[3-5]. Neurodevelopmental disorders such as autism spectrum disorder, attention deficit hyperactive disorder, and developmental delay, have also become

more common. Because their etiologies appear to be multifactorial, interest in examining potential environmental associations is increasing[6, 7].

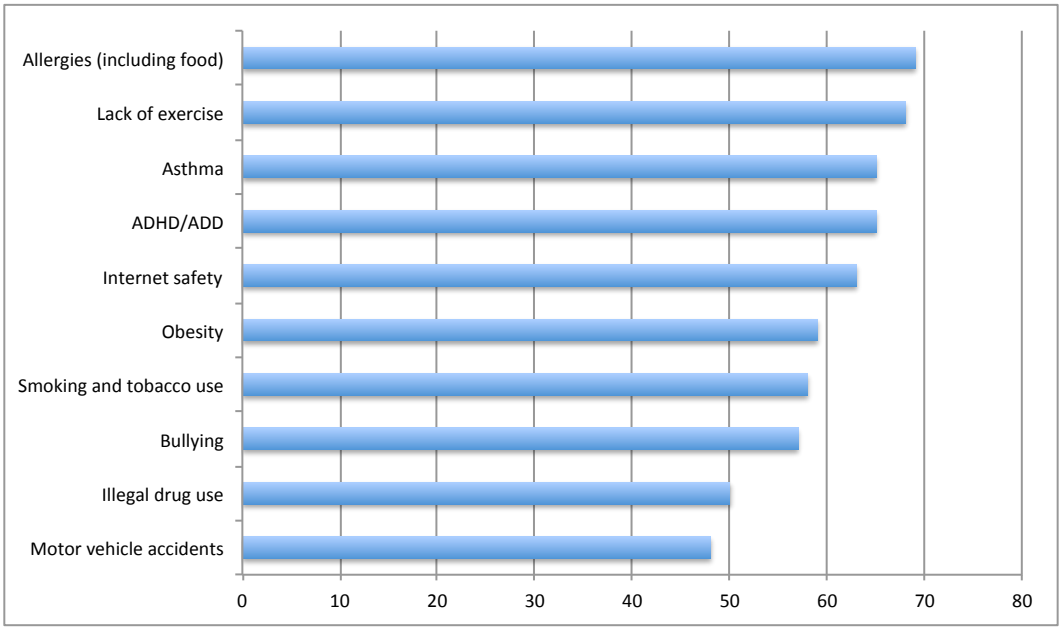

Figure 1. Top ten parental health concerns for children and adolescents ranging <2 to 17 years of age, within a local community in Washington MI (N=1119 participants), reported as percentage. Adapted from Garbutt *et al.* (2007)

Existing research studies focus largely on quantifying environmental toxicants in children and focus less on source identification through the use of questionnaires[5, 8]. For example, Fromme *et al*. (2010) aimed to quantitatively investigate maternal, fetal, and infant body burden of Poly Fluorinated Hydrocarbons and compare these to health outcomes[8]. However, source(s) of PFCs other than infant formula were not of focus or was lacking. Biomonitoring research as mentioned can be useful for quantifying environmental toxicants present in the body. However, clinical work involving an environmental history assessment through the use of questionnaires is pivotal for identifying suspected environmental exposures. Clark *et al*. (2010) suggests that clinical environmental screening is necessary to identify risk factors especially because children display behaviors that place them at higher risk to the exposures[9]. Using information gathered from questionnaires can facilitate further guidance on laboratory evaluations to strengthen the clinical suspicions, rather than 'search' or quantify unknown exposures that can be

potentially misleading[10-12]. Valuable information obtained from clinical questionnaires can also help clinicians identify aggravating risk factors in order to address parental/guardian concerns more effectively.

Need for a Global Plan of Action

Due to children's vulnerability to various environmental hazards and their harmful effects, interventions are required to protect and safeguard children's health. In an effort to implement these interventions, the last 20 years have focused on creating a policy framework led by the World Health Organization (WHO)[10]. This framework aims to "target the interventions toward vulnerable groups in order to address health and environmental problems in an integrated manner"[10]. A Global Plan of Action has further been raised with an overall goal of achieving and promoting healthier, safer, and cleaner environments for children, emphasizing on improving the identification and surveillance of children's environmental health indicators[10]. Five target areas for the WHO Global Plan of Action[10] include 1) data collection and analysis, 2) collaborative research, 3) advocacy, 4) clinical service delivery, and 5) awareness raising and education.

Environmental data collection is the first target area, and can be facilitated through the "Green Page"[13] or "Pediatric Environmental History". These resources have been made available to pediatricians, general practitioners, nurses, and clinical assistants to "encourage a clinical exploration of environmental and workplace exposure history in the context of childcare and prenatal visits"[13]. Although the Green Page provides opportunity to explore different environmental hazards and their locations, it lacks questions addressing specific conditions (e.g. respiratory and neurodevelopmental) and their environmental risk factors. Also, certain occasions require a more detailed search of sensitive exposure periods (e.g. prenatal), which require additional questions and more time for in-depth exploration. Local environmental specialists have found the Green Page has limited scope, since it does not provide a comprehensive environmental history. Therefore, in an effort to identify environmental indicators beyond the limits

offered by the Green Page, specialists at the Children's Environmental Health Clinic in Edmonton, AB rely on the **P**ediatric **E**nvironmental **H**ealth **H**istory (**PEHH**).

The Pediatric Environmental Health History (PEHH)

Local specialists have developed the PEHH over the past few years with the intent of enabling a comprehensive exploration of environmental exposures, while emphasizing the patients' "health history". The collected information is then used in conjunction with the child's medical history for a full patient evaluation. The PEHH is comprised of questions (or "items") and sections (or "domains") supported by scientific evidence, clinical experience, and expert opinion. Many of the evidence-based questions were generated over the past few years through environmental health presentations and teaching modules, which are available online through the WHO[14]. The PEHH is not designed for self-administration and requires a skilled interviewer (e.g. clinical nurse, assistant, specially trained professionals, or pediatricians) for application depending on the healthcare system and available resources.

The original PEHH version consists of nine sections (domains) with a total of 200 questions (items). These nine sections include:

Demographics,
General Environment,
School Environment,
Daycare/Day Home Environment,
Lifestyle,
Infancy/Childhood, and
Prenatal Exposures.

As a large proportion of cases encountered in the clinic were respiratory (e.g. asthma) and neurodevelopmental (e.g. ADHD, autism, developmental delay), two additional sections were added:

Respiratory Symptoms, and

Neurodevelopmental Symptoms.

The number of questions varies from 15 to 35 per section and the majority of these questions create additional space for more detailed responses. Some questions are repeated throughout the other environmental sections that are identified as being pertinent to the child.

Although used clinically for several years, formal validation of the PEHH had not yet been undertaken.

Validated clinical questionnaires and environmental health training: Importance to Children's Environmental Health

Various questionnaires exist in clinical settings to assist clinicians with patient diagnosis, prognosis, or even to assess quality of life. However, to ensure accurate data collection, a questionnaire must be assessed for its validity and reliability before application. Briefly, validity is defined as the extent to which a measurement instrument (e.g. questionnaire) measures the concept it intends to measure, and reliability is defined as the degree to which the measurement (data collected) is free from measurement error[15]. Despite the abundance of questionnaires used for a variety of purposes, a two-fold problem has been identified: a) that very few questionnaires have been validated[16, 17, 18], which could lead to potential bias or misinterpretation of the information collected, and b) that there is a lack of *reporting* regarding the use of validated questionnaires[18]. Measurement issues have therefore been recognized as an ongoing problem especially since few studies report the use of validated measures. If the studies do report, they fail to provide evidence in the form of citations[19].

An additional problem is the absence of *generic* questionnaires for use across common chronic diseases in specific populations, and even less exploring *comprehensive* environmental linkages with disease[13, 16, 20]. The Green Page[13] is no exception in part by its' limited measurement scope. The Environmental Risk Appraisal Instrument[20] developed by two, experienced nurses is another example.

Although this instrument is intended for nursing students to comprehensively assess environmental factors through visiting client homes, it lacks questions on specific occupational hazards associated with different diseases[20] that are important for a environmental health questionnaire. More importantly, it is unclear as to whether it has been validated due to inadequate reporting. Both of these examples signify the need for comprehensive and valid environmental assessment tools that can allow clinicians to explore risk factors across different environmental settings.

Inadequate environmental health training can hinder clinician confidence[21], even when valid questionnaires are unavailable to collect relevant disease information. Parents or guardians, often devastated by certain diagnoses in their child, seek physicians for etiological explanations and reassurance that further damage can be reduced or prevented. Pediatricians generally feel ill equipped to address parental concerns due to a lack of self-efficacy[22-24]. Because of this, majority of pediatricians involve tobacco smoke, pets, water, lead, and housing in their routine interviews, and additional factors apart from these are often not explored[22-24]. Few pediatricians ask about mold, heat, and indoor air upon clinical suspicions[22]. Nonetheless, a large proportion of pediatricians have a high level of interest in learning more about the field[22-24] and have a positive attitude towards conducting an environmental history with training[21], as it would lead them to "consider possible exposures through the environmental history and consider appropriate recommendations"[21].

Due to the high level of belief in environmental impacts on children's health and an overall positive attitude in conducting an environmental history[22-24], we believe that a validated PEHH may serve to bridge gaps between clinician confidence and incorporating environmental history taking in their routine practice.

The Terwee Quality Criteria: Guidelines for Questionnaire Validation

In general, measurement properties of any questionnaire provide information about the questionnaires' consistency, accuracy, and ability to detect true change. Measurement properties are not inherent traits of the questionnaire, but instead need to be considered within the context of the study and the population to which it is applied[18]. The **CO**nsensus-based **S**tandards for the **S**election of health **M**easurement **IN**struments (**COSMIN**) group has identified three main domains of measurement properties: 1) the reliability domain, which includes internal consistency, measurement error, and reliability; 2) the validity domain, which includes content validity, construct validity, and criterion validity; and 3) the responsiveness domain[25]. This taxonomy of measurement properties[26] can be referred to in Figure 2.

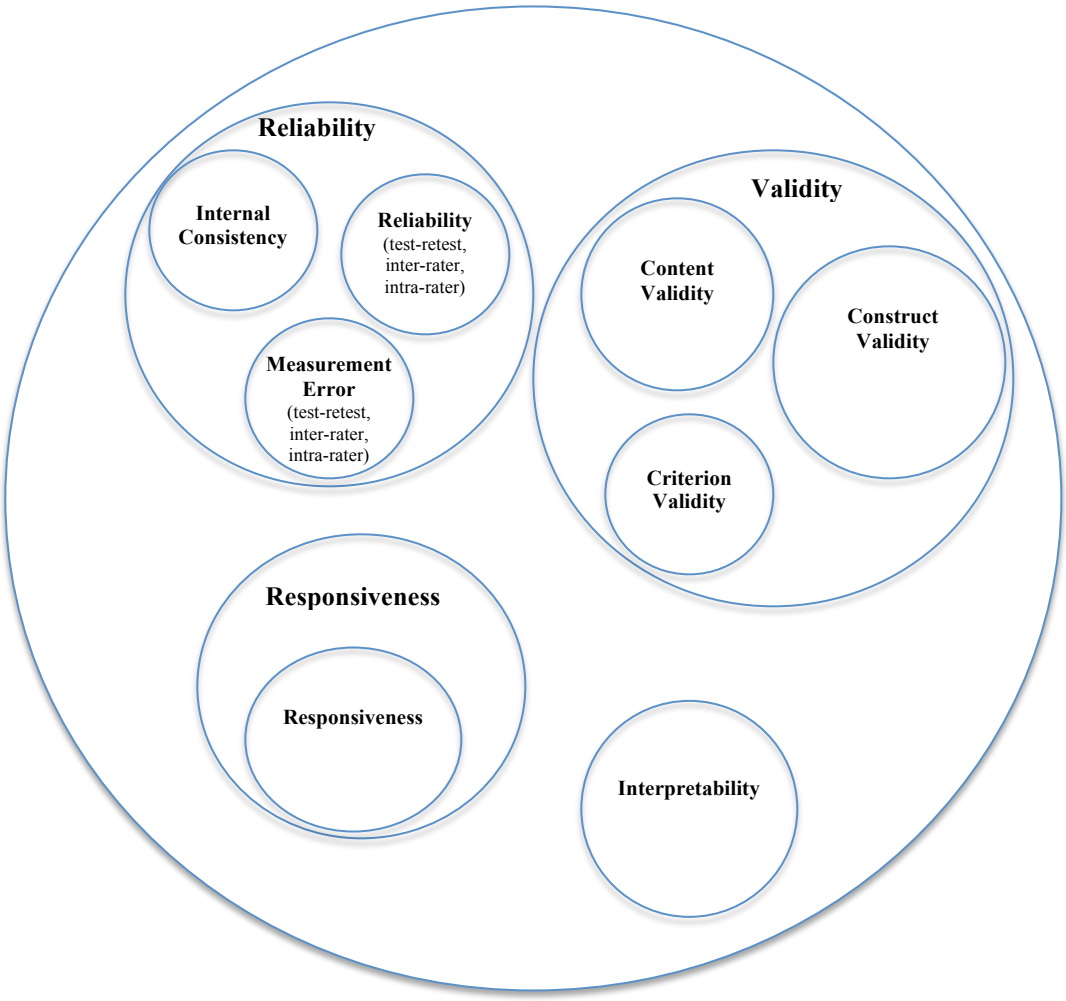

Figure 2. The taxonomy of measurement properties[26] devised by COSMIN group. Adapted from Mokkink *et al*. (2010)

The establishment of these measurement properties depends on the *purpose* of the questionnaire, which can be discriminative, evaluative, or predictive[25.,27].

- Discriminative questionnaires aim to differentiate between groups or individuals based on their differing characteristics. For example, the Short Form-36[28] can be used to determine physical, functional, and emotional aspects that are affected by the patients' condition, and can therefore distinguish patient populations that have excellent health status from those

with poor health status. The measurement properties to consider in discriminative questionnaires are internal consistency reliability and cross-sectional construct validity.

- Evaluative questionnaires aim to measure the change overtime or after a certain treatment. In addition to internal consistency reliability and construct validity, important measurement properties to consider in evaluative questionnaires are test-retest reliability and responsiveness (e.g. ability to detect change when change occurs).
- Predictive questionnaires estimate future events or changes in variables of interest. Internal consistency reliability and construct validity are important features of predictive questionnaires.

With regards to the PEHH, specific sections/domains should collect and discriminate specific environmental exposures relevant to the condition of interest (discriminative purpose). Once this discriminative purpose has been evaluated, clinicians could collect useful environmental information to fully evaluate the condition of interest (e.g. respiratory or neurodevelopmental conditions) and provide recommendations for exposure remediation accordingly. They could then determine whether there is a change in the collected environmental information in conjunction with some external measure of change such as patient symptomatology, thereby contributing to the questionnaire's evaluative purpose. Finally, in part by its predictive purpose, the collected environmental information could allow clinicians to predict future events such as a change in patient symptomatology or the establishment of exposure-related condition(s).

However, before measurement properties pertaining to any of these specific purposes can be established, the PEHH requires content validity as a primary validation step. According to Terwee (2007), content validity is described as the extent to which the domain of interest is comprehensively sampled by the items in the questionnaire[27]. Establishing the content of a questionnaire is an iterative process, thereby depending on an accumulation of evidence[27]. Content validity is

considered one of the most important measurement properties, as this can further lead to the evaluation of other measurement properties (e.g. construct validity, reliability, etc.)[25, 27, 29]. Terwee (2007) has contributed to the development of explicit quality criteria for the assessment of content validity[27]:

- A positive rating, "+", is given to studies if "a clear description [is] provided of the measurement aim, the target population, the concepts that are being measured, and the item selection AND target population and (investigators OR experts) were involved in item selection"[27].
- A questionable rating, "?", is given to studies if "a clear description of above-mentioned aspects is lacking OR only target population involved OR doubtful design or method"[27].
- A negative rating, "-", is given to studies if there is "no target population involvement"[27].
- A zero rating, "0", is given to studies if "no information is found on target population involvement"[27].

Following the recommendations provided by Terwee (2007) we could ensure that the quality criteria for establishing the content for the PEHH have been addressed. A PEHH with established content validity can result in future:

a) Comprehensive exploration of environmental risk factors, thereby addressing the Global Plan Action target #1 (data collection and analysis)[10].
b) Establishment of other measurement properties, such as discriminative, predictive, and evaluative construct validity, and internal consistency reliability, based on its' intended purposes.

Thesis Objective

This thesis aims to establish PEHH content validity based on the described and recommended Terwee quality criteria[27]. More specifically we aim to ensure the inclusion of a relevant and comprehensive set of questions/items to collect

environmental exposure information relevant to pediatric conditions. To do this, we sought valuable feedback from environmental experts. These experts were asked to "judge the relevance and comprehensiveness"[27] of the questions for the underlying concept of the PEHH - pediatric environmental health. Members of the Children's Environmental Health team thoroughly discussed their suggestions and used predetermined criteria to select the items to be added, re-worded, or deleted for creation of a new version, which was subject to a second round of expert feedback. Specific criteria for item selection are described in the first phase of the study.

Once the experts defined the content, the PEHH was piloted with parents and guardians to assess its usability through examining its comprehension[26] and respondent burden. This is because "with existing instruments, it cannot be assumed that the instrument has content validity if patients were not involved in instrument development"[29]. We didn't include children in assessing PEHH usability since they are too young and are not direct questionnaire respondents. Finally, due to the identified limitations in the clinical use of environmental health history such as low clinician confidence and lack of environmental health training[21-24], we explored the opinions of pediatricians on the usefulness of the PEHH for clinical practice. Although assessing usefulness is not explicitly stated by the Terwee quality criteria[27], it would allow us to identify aspects of the PEHH itself that are of concern to pediatricians.

Specific Thesis Objectives (Table 1)

Phase I: To utilize a modified Delphi technique to collect expert consensus for each PEHH section/domain and identify areas requiring modification. Specific *a priori* criteria of a percent agreement of at least 90% for each section/domain will determine the need for additional rounds of expert feedback[30, 31].

Phase IIA: To pilot the revised PEHH with parents/guardians and evaluate its usability, including an examination of its comprehension and respondent burden.

Phase IIB: To evaluate the usefulness of the PEHH for clinical practice based on feedback from pediatricians.

Discussion and Conclusions

Table 1. Specific Thesis Objectives to Attain PEHH Content Validity

Specific Objective	Methods
1. Collect expert consensus and suggestions on the content of each section/domain	-Modified Delphi technique -Percent Agreement (PA) per section/domain -Response inconsistencies -Create a new version for pilot study.
2.a. Pilot the PEHH with parents/guardians and assess usability 2.b. Assess usefulness with pediatricians	-Telephone administration followed by a usability survey -Online usefulness survey
3. Discussion and Conclusions	-Interpretations and future recommendations

Phase I: Expert Feedback – An Iterative Process

Objective

This objective of this phase was to collect expert consensus for the relevancy of the questions/items pertaining to each PEHH section/domain, and identify areas requiring modification to create a new version.

Methods

Expert Participants

Expert feedback was gathered using a modified Delphi technique. The Delphi technique is an iterative process that involves at least two rounds of feedback from a panel of experts[32-24]. Strengths of using this technique include: participant anonymity among the experts, controlled feedback, and statistical group response[32-34]. The first round of the Delphi technique typically requires the panel of experts to generate or brainstorm ideas that could be explored by the concept of interest[32.35]. The generated ideas are summarized and then reverted to the experts in subsequent rounds for their judgment[32]. Since the questions have already been generated for the PEHH, this task would not be necessary, hence the modified Delphi[36]. Masking the participant's identities from one another ensured participant anonymity. The feedback was controlled by providing participants with the modified questionnaire and their original responses for a second round of content assessment. Lastly, group responses were evaluated through collecting expert consensus for the content comprising each PEHH section/domain.

Environmental experts were identified mainly throughout the **P**ediatric **E**nvironmental **H**ealth **S**pecialty **U**nits (**PEHSUs**) network[37]. The PEHSUs aim to diagnose and treat children with diseases that display a toxic environmental origin, reduce/prevent environmental health threats to children, and work towards improving practitioner access to expertise in environmental medicine[37]. The first PEHSU programs were established in 1998 in Seattle and Boston as a result of

two, large environmental exposure incidents[37]. Briefly, the first incident involved exposure to mercury vapor in an apartment building that was formerly used for industrial purposes[37]. The second involved methyl parathion exposure, which affected a large number of children in 9 different states[37]. Currently the PEHSUs include 12 sites in total, of which ten are found across the United States, 1 in Mexico, and 1 in Canada[38]. The different PEHSUs in the United States are allocated in each one of the ten Environmental Protection Agency regions, providing service to their regions.

An updated list of PEHSU staff, which is available for internal staff use, consists of sixty PEHSU members along with their listed qualifications. The typical PEHSU staff includes a project director, a coordinator, an occupational environmental medicine physician, a pediatrician, and often other specialists such as toxicologists or industrial hygienists[39]. In addition to the PEHSU list, an online global health observatory data repository is available through the World Health Organization (WHO), the main promoter of Children's Environmental Health. This repository consists of aggregated data for environmental health and public health workers on an international level[40]. However, because the repository was not precise enough to identify experts as per our criteria (see below), experts throughout the WHO could only be identified via established clinical contacts. Our experts were chosen because of their knowledge of the topic area of interest. Using specific inclusion and exclusion criteria for selecting our experts (see below), we ensured that we received feedback from a homogeneous group. A homogeneous group is "a group of experts from the same general discipline area"[33]. Because our "Delphi subjects are [assumed to be] highly trained and competent within the specialized area of knowledge related to the target issue"[32] - namely pediatric environmental health, we could ensure the inclusion of a homogeneous panel of experts.

Expert Inclusion and Exclusion Criteria

Expert participants were eligible as per the following inclusion and exclusion criteria:

1. If they are affiliated to the PEHSU or identified as affiliated to the WHO
   (If "no": EXCLUDE)
2. If they have a *pediatric* environmental health background. We wanted to ensure that their environmental expertise resides specifically within pediatric disciplines. These disciplines could include for example, allergy/immunizations, respirology, neurodevelopment, toxicology, and environmental medicine[37, 38].
   (If "no": EXCLUDE)
3. If they have at least an MD qualification. This was a requirement for all of the participants.
   (If "no": EXCLUDE)
4. If they have a *clinical* appointment. This was because the questionnaire is intended for the clinical setting.
   (If "no": EXCLUDE)
5. If they are English speaking.
   (If "no": EXCLUDE)

The number of experts "often depends on how many accessible and agreeable persons the instrument developer can identify"[30]. We anticipated a small number of experts as per our inclusion and exclusion criteria and therefore did not expect a large number of participants. Based on previous studies utilizing iterative methodologies, we could anticipate a 70% response rate to participation and 65% of these would complete the first round[41, 42]. E-mail invitations were sent to the selected individuals, requesting their participation. It has been suggested that for content validity, a minimum of 5 experts would be sufficient and that the maximum is unlikely to exceed ten[30]. It has also been proposed "with a homogeneous groups of experts, acceptable results can be achieved with small

panels of 10-15 individuals[32, 33, 43]. For the purpose of this study which is to establish content validity, and because we are seeking specifically pediatric environmental health feedback, our minimal acceptable sample was 10 experts to constitute a homogeneous sample.

Pediatric Environment Health History Evaluation

Researchers and clinicians involved in Children's Health and the Environment developed the Pediatric Environmental Health History (Appendix A), consisting of nine sections ("domains") and 200 questions ("items"). These nine sections are as follows:

1. Demographics
2. General Environment
3. School Environment
4. Daycare/Day Home Environment
5. Lifestyle
6. Prenatal Exposures
7. Infancy/Childhood
8. Respiratory Symptoms related environmental questions
9. Neurodevelopmental Symptoms related environmental questions

For the purpose of this study, the original PEHH was transcribed into REDCap, which is an "electronic data capture tool hosted and supported by the Women and Children's Health Research Institute's Clinical Research Informatics Core" at the University of Alberta[44]. "REDCap is a secure, web-based application designed to support data capture for research studies, providing: 1) an intuitive interface for validated data entry; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for importing data from external sources"[44].

Participants received a REDCap online survey with the original PEHH attached. The survey instructions can be referred to in Appendix B. The survey consisted of

two components per section (domain), which required expert appraisal. The first component involved an **item-level appraisal,** requiring the experts to thoroughly review the *relevancy* of each question (item), per section (domain). Experts were to select one of the following response options: "agree" or "requires modification". Upon selecting the "requires modification" response option, they were requested to specify their desired change for the respective item.

The second component involved a **global appraisal,** which included 4 global questions for overall assessment of each domain: 1) relevancy, 2) comprehensiveness, 3) relevancy to the pediatric population, and 4) accurate reflection of the underlying concept (PEHH). Five possible response options to these questions were provided and coded on a Likert scale: 1=strongly disagree, 2=disagree, 3=no opinion, 4=agree, and 5=strongly agree. The minimal overall rating per global question would be 1 and the maximal 5. Each expert was to provide a total of 36 ratings, one for each of the 4 global questions per 9 sections/domains. The median global ratings were determined for each expert. Depending on the number of participating experts, an *overall* median global rating would be derived for each global question.

Finally, the experts were given opportunity for additional open-ended comments/suggestions at the end of each section/domain. These were referred to as the "**domain-level**" suggestions.

The "item-level" and "domain-level" suggestions were categorized into the following modification categories of interest: item re-wording, additions, clarifications, or deletions[29]. The numbers of suggested modifications at the "item-level" and "domain-level" were summed for each expert to determine the total. Suggestions at the 'domain-level' were counted if not already mentioned at the 'item-level'. Local members of the Children's Environmental Health team, consisting of an environmental health clinician, an environmental research specialist, and a graduate student, thoroughly discussed suggestions that appeared

controversial (e.g. if a suggestion appeared to be vague or unclear to the graduate student, or if specific re-wording was suggested from different experts, or if specific wording of the item was required to address patient sensitivity, etc.). Complete consensus was reached before the suggestion was rejected or incorporated into the new version. Although some bias may have existed within the team discussion, the selection of the items to reject or incorporate in the new version depended on specific criteria as follows:

Suggested modifications were accepted for incorporation:

1. If the suggestion was provided by at least 1 expert (e.g. relevant exposure to explore in the domain of interest, or re-wording for more clarity, etc.).
2. If the suggested addition was anticipated to be useful to enhance overall PEHH comprehensiveness without displaying redundancy
3. If the suggested addition was not already adequately explored in another domain (e.g. not redundant).
4. If the suggested addition was anticipated to provide useful information regarding a clinical understanding of the patient's condition/symptomatology.
5. If the suggested addition had sufficient evidence supporting its' exploration (literature would be reviewed if necessary).
6. If the suggested modification would improve item clarity.
7. If the suggested modification (e.g. re-wording) was phrased in Canadian-English.

Suggested modifications were rejected for incorporation:

1. If the suggested modification appeared to be vague.
2. If the suggested addition was already adequately explored in subsequent questions or in another domain (e.g. collects redundant information).
3. If the suggested item addition was not anticipated to provide useful information regarding clinical understanding of the patient's condition.
4. If the suggested item addition had insufficient evidence supporting its' exploration.

5. If the suggested item modification was not thought to improve item clarity.
6. If the suggested item modification (e.g. re-wording) was not phrased using Canadian-English.
7. If the suggested item modification was explored in the patient's medical history.

Expert Consensus

Expert consensus was determined per section/domain through the Percent Agreement (PA) statistic[31]. PA is an average percent of *experts* rating an individual question/item as relevant (e.g. "agree") per section/domain[30]. Methods for assessing content validity have no devised standards, as this requires a subjective judgment[45]. Due to the dichotomous nature of our survey responses, expert consensus for conducting domain-level analyses was determined through Percent Agreement, as recommended by Polit *et al*. (2006)[31]. This approach places less stringent demands compared to the *universal* approach that requires 100% agreement or "Universal Agreement" from the experts[31]. Computing Universal Agreement is not preferred if there are a large number of experts participating, as this can depress the consensus that is in reality achieved[31]. Therefore, a less conservative approach focusing on Percent Agreement is desired when a large number of experts are participating[31]. For 5 or fewer experts, the section/domain of interest is required to have a Percent Agreement of 100% for "excellent content validity"[30, 31]. A panel involving 6-10 experts requires a Percent Agreement of 90% in order for a section/domain to have "excellent content validity"[30]. Additional rounds of expert review would be required if the recommended criteria have not been achieved, suggesting a need for question/item improvement[31].

If subsequent rounds of expert review were required, we sought participation from only those who completed the first round. These original participants would allow us to determine whether the modifications that we made based on *their suggestions* resulted in content improvement. Experts would retrieve the online

survey, a copy of their original survey responses, and both PEHH versions for reference to the modifications that were made.

Statistical Analysis

The standard deviation for Percent Agreement was used as a measure of opinion convergence for each PEHH section/domain. A lower standard deviation and an increase in Percent Agreement would indicate greater convergence of opinion and content improvement, respectively. Median expert ratings were determined for each global question due to anticipated small sample size. Higher median ratings in conjunction to a decrease in the rating range would indicate higher agreement with the global questions and content improvement. All descriptive data analyses were conducting using STATA version 13, statistical software.

Exploring expert response inconsistency using scores

The percent of questions deemed relevant per section (or "item appraisal") and global *relevancy* ratings (or "global appraisal") were converted into scores on a scale of 0 to 100 for each expert. We used this scoring scale so that data could be appropriately comparable.

Domain Scores

Scores represent the percentage of total possible score achieved[46]. The minimum percent of items that an individual expert can agree with is 0 and the maximum is 100. Higher domain scores are indicative of higher agreement with the *relevancy* of the items contributing to the domain of interest. For example, an expert agreeing with 57% of the items in domain 1 will receive a score of 57.

Global Relevancy Scores

The minimum *global relevancy* rating is 1 (strongly disagree) and the maximum is 5 (strongly agree). These global relevancy ratings were transformed and scored on a scale of 0 to 100, as per the given formula:

Score = *(Observed Rating-Min)/(Range) *100*

The range is equal to the maximum possible rating minus the minimum possible rating. Higher global relevancy ratings are indicative of higher *holistic* agreement with the relevancy of the items, per domain. Similar scoring was used by Hays (1993), "so that the lowest and highest possible scores are set at 0 and 100, respectively"[46]. Similar to the 'domain scores', these global relevancy scores represent the "percentage of total possible score achieved"[46].

1 = Strongly disagree → **0**
2 = Disagree → **25**
3 = Neutral → **50**
4 = Agree → **75**
5 = Strongly Agree → **100**

We hypothesized that high "domain scores" would correspond to high "global *relevancy* scores" for the domain of interest. Each expert was to provide a global relevancy rating for each domain, rendering a total of 9 ratings per expert. The difference between their domain scores and global relevancy scores were computed. These score differences were then transformed into z-scores, which would allow us to interpret the score differences relative to one another. We rendered score differences beyond 2 SDs "inconsistent" as these would indicate a greater discrepancy in the item-level and global-level 'relevancy' responses. Two SDs was arbitrarily selected as our cut-off point, as an indicator of containing 95.45% of the normally expected variability. The experts that provided inconsistent response sets were then identified.

Inconsistent experts - analysis of unique item-level suggestions

Upon identifying the "inconsistent" experts, the number of unique item-level suggestions that they provided was determined. We defined unique suggestions as those that have not been suggested by other panel members. As an indication of whether other panel members approved/disapproved of these incorporations, we looked at the consensus achieved for these questions/items and if further suggestions were given in round 2. This

would therefore protect against the removal of suggestions that would otherwise be assumed to be aberrant.

Results

Based on our inclusion criteria, thirty-two environmental experts were identified throughout the PEHSU regions, and ten throughout the WHO, for a total of 42 eligible participants. From the 42 potential participants identified, 22 agreed to participate in the study. Two declined due to lack of time, and one declined, as he was not doing any current work in pediatric environmental health. The remainder did not respond to our e-mail invitations. Of those who agreed to participate, only 12 submitted the surveys. Two surveys, despite their submission, were excluded from the analysis due to incompletion. These experts were contacted for re-submission, but were not reachable. The analysis therefore, depended on 10 complete survey responses. Eight experts were from the USA, one from Canada and one from Uruguay. They represented expertise in pediatric toxicology, preventative medicine, developmental pediatrics, hazard assessment, general pediatrics, and clinical pharmacology. Nine experts have completed pediatric residency training and 3 years of postdoctoral fellowship training in environmental health, and one expert has completed a one-year diploma in environmental health. Their experience in pediatric practice ranged from 5 to 35 years. Eight of these experts currently are affiliated with an American PEHSU and 2 experts (from Canada and Uruguay) see patients with environmental concerns in a regular clinical setting.

Number of Suggested Modifications

The 10 experts provided a total of 289 suggestions based on the four categories of suggested modifications: re-wording, additions, clarifications, and deletions (Tables 2 and 3). These item-level suggestions involved 55% of the questions throughout the entire PEHH. One hundred and forty-eight (51%) of the total suggestions were additions, indicating potential towards improving PEHH comprehensiveness (Table 3). It appeared that a high number of clarifications were required for the Lifestyle domain (Table 3). Experts #4 and #6 also

suggested majority of the total clarifications (Table 2). Overall, the suggested modifications at both the "item-level" and "domain-level" can be referred to in Appendix C.

Table 2. Number of suggestions per modification category, by *expert*

Expert #	Re-wording	Additions	Clarifications	Deletions	Total
1	0	4	0	0	**4**
2	5	21	0	0	**26**
3	4	12	1	0	**17**
4	17	22	15	1	**55**
5	9	10	1	0	**20**
6	11	17	19	3	**50**
7	3	22	0	0	**25**
8	11	12	2	0	**25**
9	17	9	3	0	**29**
10	12	19	6	1	**38**
Total	**89**	**148**	**47**	**5**	**289**

Table 3. Number of suggestions per modification category, by *domain*

Domain	Re-wording	Additions	Clarifications	Deletions	Total
1. Demographics	16	10	8	0	**34**
2. General Environment	9	37	4	0	**50**
3. School Environment	3	28	2	0	**33**
4. Daycare/Day Home Environment	4	16	0	0	**20**
5. Lifestyle	18	11	17	0	**46**
6. Prenatal Exposures	17	12	8	0	**37**
7. Infancy/Childhood	1	11	1	2	**15**
8. Respiratory Symptoms	4	11	4	1	**20**
9. Neurodevelopmental Symptoms	17	12	3	2	**34**
Total	**89**	**148**	**47**	**5**	**289**

Expert Consensus

The Percent Agreement for the nine sections/domains ranged from 79% to 94% with the lowest representing the Lifestyle section and the highest representing the Neurodevelopmental section, respectively (Table 4). Survey and PEHH reiteration was required since 5 of the sections did not meet the acceptable criteria for "excellent content validity"[30].

Table 4. Percent agreement: average percent of experts who agreed with the item relevancy, per section/domain (n=10 experts)

Domain			Expert											
		Number Of Items	1	2	3	4	5	6	7	8	9	10	Percent Agreement	Standard Deviation
	Demographics	23	100	91	100	74	96	61	87	100	87	78	87%	±13.03
	General Environment	29	100	86	100	72	97	90	90	97	86	76	89%	±9.70
	School Environment	16	100	81	100	63	100	88	88	88	81	100	89%	±11.98
	Daycare/Day Home Environment	17	100	71	100	94	100	94	100	100	82	88	93%	±9.87
	Lifestyle	21	100	100	81	67	76	43	90	62	71	95	79%	±18.45
	Prenatal Exposures	32	100	88	94	72	100	75	94	97	88	88	89%	±9.66
	Infancy/ Childhood	11	91	91	100	100	100	64	91	100	100	82	92%	±11.58
	Respiratory Symptoms	15	100	100	93	73	100	93	100	100	100	73	93%	±31.15
	Neurodevelop-mental Symptoms	36	100	100	100	81	100	100	100	89	97	69	94%	±31.20

Global Appraisal

Table 5 displays an example of the overall median global relevancy rating for the 10 experts. The overall median ratings were similarly derived for the remainders of the global questions. All of the global questions had overall median ratings of 4 (agree). Global comprehensiveness had the largest rating range of 2 (disagree) to 5 (strongly agree) suggesting the need to improve the questionnaire's comprehensiveness (Table 6).

Table 5. Ratings for the global *relevancy* question (n=10 experts)

		Expert									
Domain		1	2	3	4	5	6	7	8	9	10
	Demographics	4	4	5	5	5	4	5	4	4	4
	General Environment	4	4	5	4	4	4	5	4	5	4
	School Environment	4	4	5	5	4	4	5	4	5	4
	Daycare/Day home Environment	4	4	5	4	4	4	5	4	5	4
	Lifestyle	4	4	5	4	4	4	5	4	5	4
	Prenatal Exposures	4	4	5	4	3	4	5	4	4	4
	Infancy/Childhood	4	4	5	4	3	4	5	4	4	4
	Respiratory Symptoms	4	4	5	4	3	4	5	4	5	4
	Neurodevelopmental Symptoms	4	4	5	2	4	4	5	4	5	4
	Median Rating/Expert	**4**	**4**	**5**	**4**	**4**	**4**	**5**	**4**	**5**	**4**
	Overall Median (Range)	**4 (4 - 5)**									

Table 6. Median "global appraisal" ratings from round 1 (n=10 experts)

Global Question:	1. The items are overall relevant to the respective domain	2. The items are overall comprehensive within the respective domain	3. The items are an accurate reflection of the underlying construct (PEHH)	4. The items are overall relevant to the pediatric population
Median Rating (Range)	4 (4 - 5)	4 (2 - 5)	4 (3 - 5)	4 (4 - 5)

Consistency of expert responses

Appendix D displays the differences between the domain relevancy scores and global relevancy scores. Ninety score differences and their transformed z-scores were computed (9 domains *x* 10 experts = 90 scores). The mean score difference was 16.1 (SD 12.4). Only 4 out of 90 score differences were beyond 2 SDs from the standardized mean difference of 0, indicating response inconsistencies (Appendix D). Two experts provided these score differences. Expert #5 had a

score difference of 50 in three domains 6, 7, and 8 (Appendix D). Expert #4 had one inconsistent response in domain 9 with a score difference of 52 (Appendix D).

Expert #4 provided a total of 31 unique item-level suggestions, of which 16 questions required re-wording, 8 required clarifications, and six additions were requested (Appendix C). Twenty-four out of the 31 suggestions were accepted as per our question inclusion/exclusion criteria and incorporated into the second version (v2). Expert #5 provided 2 unique item-level suggestions, in which only 1 addition was incorporated into General Environment domain for v2. These unique expert suggestions are highlighted in Appendix C and whether they were accepted or rejected, and the reasons for rejection.

Of the total 289 suggestions provided by the 10 experts, 182 were accepted and 107 were rejected. As suggested by our experts, we further re-named a few sections. The Demographics section was re-named "General Information" since family history questions are also explored within this section. The Infancy/Childhood section was re-named "Infancy Diet" since majority of the questions explore dietary behavior. Lastly, since the focus of the Respiratory and Neurodevelopmental sections was on environmental risk factors known to affect these symptoms rather than on the symptoms per se, we re-named these sections "Additional Environmental Factors Affecting Respiratory Symptoms" and "Additional Environmental Factors Affecting Neurodevelopmental Symptoms". Other accepted suggestions can be referred to in Appendix C.

Examples of rejected suggestions as per specific criteria were those that would provide redundant information, were not anticipated to clinically enhance understanding of the patient, and were not phrased in Canadian-English. For instance the suggested addition exploring 'cockroaches' was rejected due to question redundancy, as insects in general are explored by question #188 "Do you see insects…in your home?" Other examples of rejected suggestions and the

reason for rejection can be referred to in Appendix C. Sixty-seven questions were re-worded and there was an addition and deletion of 69 and 21 questions, respectively, resulting in a total of **248 questions/items** in v2

E.g. Original 200 questions/items
+ 69 questions
- 21 questions
= **248 questions in v2**

The second version can be referred to in Appendix E. A map of the questions/items in each PEHH version can be referred to in Appendix F, portraying questions that were added, re-worded and deleted in each version, and the subsequent question/item re-numbering in each version. For example, question #150 in version 1 corresponds to question #194 in version 2 (Appendix F). This second version was re-sent to the original participating experts for a second round of review.

Results: Round 2

Number of Suggested Modifications from Round 2

In round 2, only 9 of the original 10 experts participated. Eight of these experts completed a full survey and one globally appraised each domain. The 8 experts provided a total of **118 suggestions** involving only **32% (79)** of the questions (Tables 7 and 8). The majority of these suggestions included question re-wording (n=58 or 49%) and fewer additions were required (n=45 or 38%). The remaining suggestions include question clarifications (n=12 or 10%) or deletions (n=3 or 3%). Of the total 118 suggestions, 33 were recurrent and involved 25 questions. This indicated that the presented question/item concerns from round 1 either did not demonstrate improvement, or that further modifications were required such as re-wording for more clarity. Examples of questions that received recurrent concern were those exploring gas stations and dry cleaners (questions #31 and 32). Since the experts questioned the rationale behind the distance explored in these questions, they were deleted from each pertinent section after round 2.

Table 7. Number of suggestions per modification category from round 2, by *expert*

Expert #	Re-wording	Additions	Clarifications	Deletions	**Total**
1	0	1	0	0	**1**
2	5	0	1	0	**6**
3	13	16	1	0	**30**
4	3	9	7	3	**22**
6	2	5	0	0	**7**
7	10	5	0	0	**15**
9	0	4	1	0	**5**
10	25	5	2	0	**32**
Total	**58**	**45**	**12**	**3**	**118**

Table 8. Number of suggestions per modification category from round 2, by *domain*

Domain	Re-wording	Additions	Clarifications	Deletions	**Total**
1. General Information	8	2	0	0	**10**
2. General Environment	14	10	4	1	**29**
3. School Environment	7	4	2	0	**13**
4. Daycare/Day Home Environment	2	1	1	0	**4**
5. Lifestyle	3	7	1	0	**11**
6. Prenatal Exposures	9	1	0	0	**10**
7. Infancy Diet	9	3	1	0	**13**
8. Env. Factors Affecting Respiratory Symptoms	3	11	3	0	**17**
9.Env. Factors Affecting Neurodevelopmental Symptoms	3	6	0	2	**11**
Total	**58**	**45**	**12**	**3**	**118**

Differences in the total number of suggestions for each modification category in Round 1 and 2 are summarized in Figure 3. Figures 4 to 6 summarize individual expert response patterns, which were analyzed as an independent task. Generally, we found that the number of suggested additions decreased for each expert in round 2, except for expert #3 who became slightly more critical with the comprehensiveness (Figure 5). His median global comprehensive rating reinforces this, which decreased from 5 (strongly agree) in round 1, to 4 (agree) in round 2.

Further, despite that the overall number of question re-wording decreased in round 2 (Figure 3), experts #3, 7, and 10 became more critical or generally agreed less with the clarity of the questions (Figure 4). A few of the new additions in v2

also required re-wording for more clarity. For example, question #67 "How does your child get to school?" was re-worded to "What is the most usual mode of transportation your child uses to get to school?" This re-wording exemplifies that the *most usual mode* is of interest as opposed to all of the different ways the child can get to school, thereby allowing the respondent to focus on providing a specific answer. Finally, majority of the experts requested fewer clarifications in round 2, indicating that the questions were less vague (Figure 6).

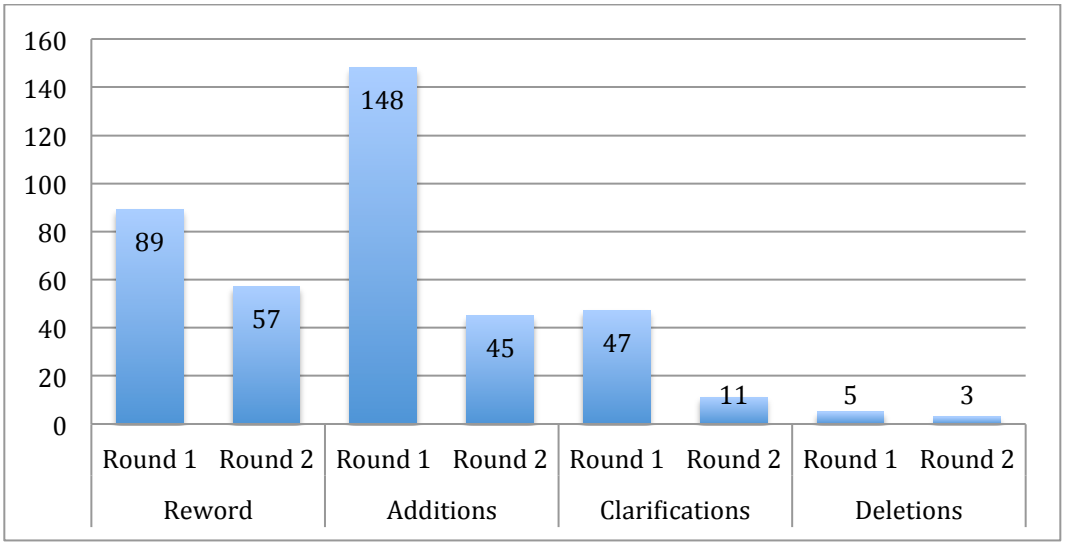

Figure 3. Summary of the total number of suggestions per modification category from rounds 1 (n=10 experts) and 2 (n=8 experts)

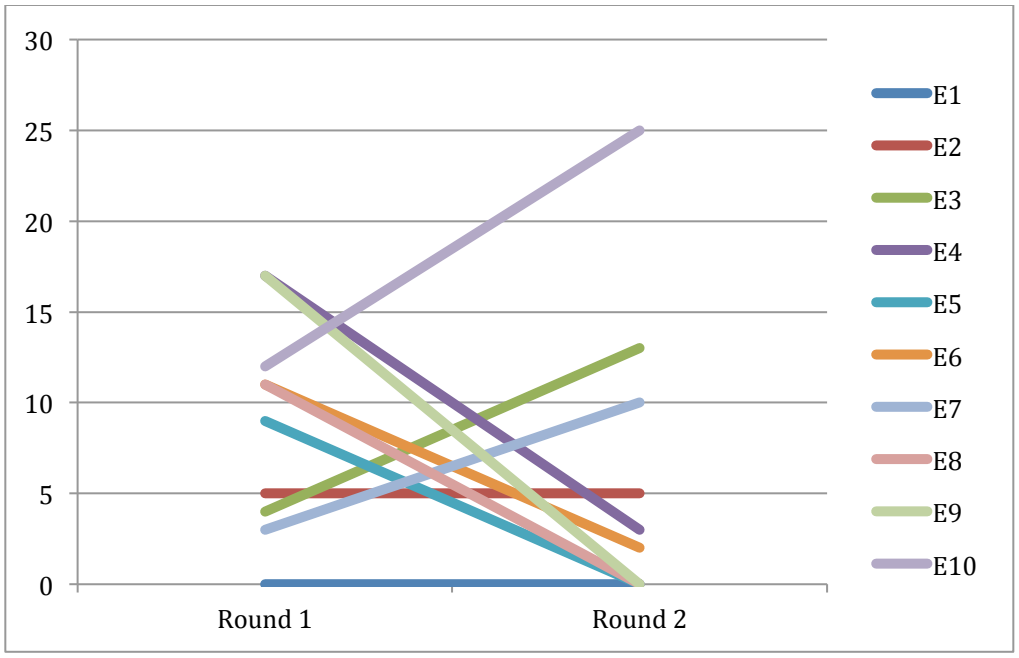

Figure 4. Total number of suggested question re-wording per expert from rounds 1 (n=10 experts) and 2 (n=8 experts)

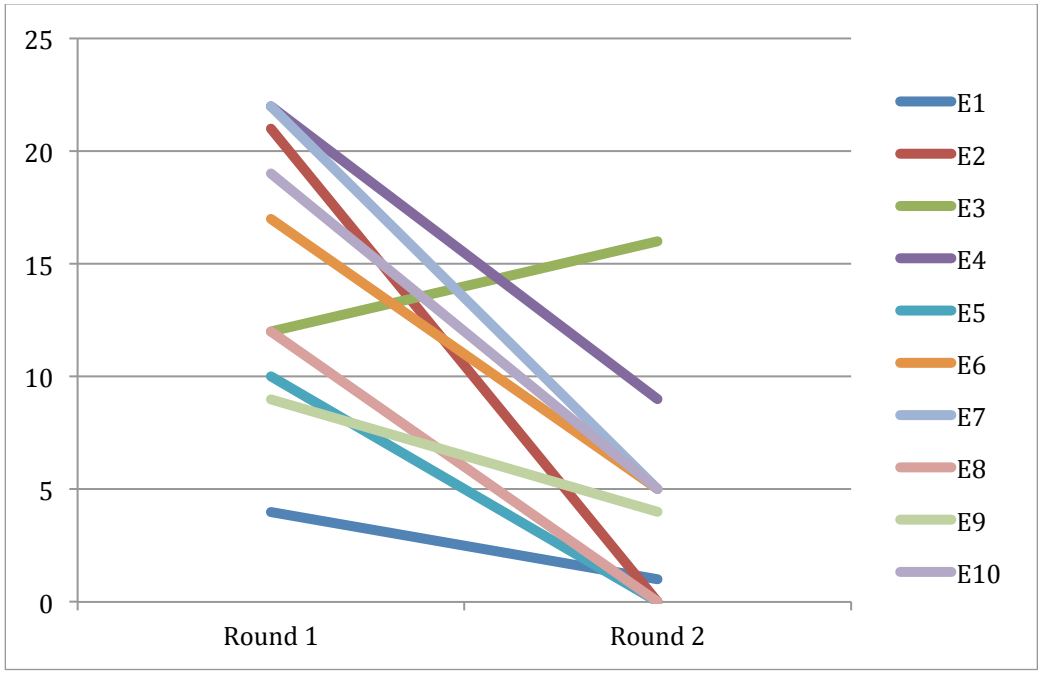

Figure 5. Total number of suggested additions per expert from rounds 1 (n=10 experts) and 2 (n=8 experts)

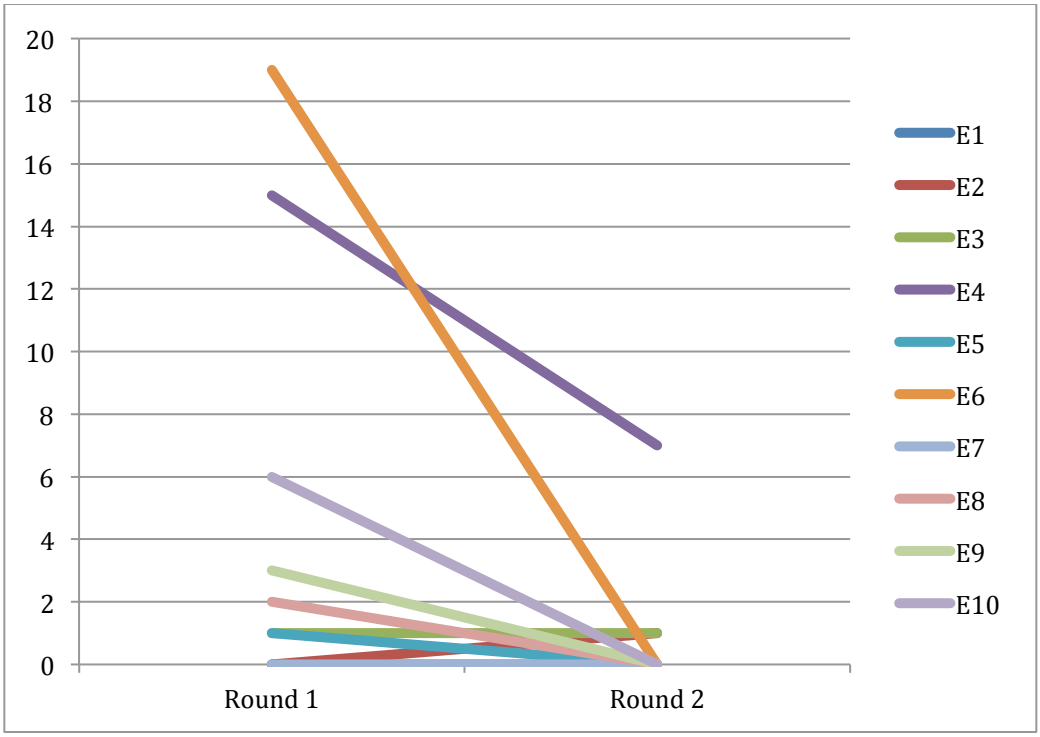

Figure 6. Total number of item clarifications per expert from rounds 1 (n=10 experts) and 2 (n=8 experts)

Expert Consensus from Round 2

The Percent Agreement ranged from 91% to 98% (Table 9). Eight sections demonstrated improvement in part by an increase in Percent Agreement (Table 10). The standard deviation decreased for all of the sections, indicating reduced variation and therefore more response homogeneity (Table 9). All of the sections met the acceptable criteria for "excellent content validity"[30] rendering subsequent rounds of expert feedback unnecessary. Numerical differences in the number of questions/items per section/domain within each version of the PEHH can be referred to in Table 10.

Table 9. Percent agreement of experts who agreed with the question relevancy per section from round 2 (n=8 experts)

Domain			Expert #									
		Number of items	1	2	3	4	6	7	9	10	Percent Agreement	Standard Deviation
	General Information	26	100	100	96	100	92	92	100	81	95%	(±6.71)
	General Environment	38	97	92	87	82	97	95	100	84	92%	(±6.67)
	School Environment	26	100	92	96	92	100	96	100	85	95%	(±5.28)
	Daycare/Day Home Environment	26	100	100	100	96	96	100	100	92	98%	(±3.02)
	Lifestyle	20	100	100	95	80	100	90	100	85	94%	(±7.91)
	Prenatal Exposures	40	100	100	93	100	100	95	100	85	97%	(±5.45)
	Infancy Diet	17	100	94	76	88	100	76	100	94	91%	(±10.14)
	Respiratory Symptoms	15	100	100	86	86	100	100	95	86	94%	(±6.94)
	Neurodevelop-mental Symptoms	36	100	100	94	91	100	97	100	94	97%	(±3.59)

Table 10. Expert Consensus: Percent agreement (PA) per domain, from surveys round 1 (n=10 experts) and round 2 (n=8 experts)

Round 1 (Version 1)			
Domain	**Number of Items**	**Percent Agreement**	**Standard Deviation**
Demographics	23	87%	±13.03
General Environment	29	89%	±9.70
School Environment	16	89%	±11.98
Daycare/Day Home Environment	17	93%	±9.87
Lifestyle	21	79%	±18.45
Prenatal Exposures	32	89%	±9.66
Infancy/Childhood	11	92%	±11.58
Respiratory Symptoms	15	93%	±31.15
Neurodevelopmental Symptoms	36	94%	±31.20

Round 2 (Version 2)			
Domain	**Number of Items**	**Percent Agreement**	**Standard Deviation**
General Information	26	95%	±6.71
General Environment	38	92%	±6.67
School Environment	26	95%	±5.28
Daycare/Day Home Environment	26	98%	±3.02
Lifestyle	20	94%	±7.91
Prenatal Exposures	40	97%	±5.45
Infancy Diet	17	91%	±10.14
Respiratory Symptoms	22	94%	±6.94
Neurodevelopmental Symptoms	33	97%	±3.59

Global Appraisal from Round 2

The overall median ratings for the global questions remained at 4 (agree) in both rounds (Table 11). In round 2, the rating range decreased for global comprehensiveness to between 4 (agree) and 5 (strongly agree). The responses for all of the global questions range between 4 (agree) and 5 (strongly agree) (Table 11). Overall, content improvement is suggested by a decrease in the number of suggested item additions, decreased standard deviation for the Percent Agreement per section, and a decreased global rating response range.

Table 11. Summary comparison of median global ratings from rounds 1 (n=10 experts) and 2 (n=9 experts)

Global Question:	**Round 1**	**Round 2**
	Overall median rating (Range)	**Overall median rating (Range)**
1. The items are overall relevant to the respective domain	4 (4 - 5)	4 (4 - 5)
2. The items are overall comprehensive within the respective domain	4 (2 - 5)	4 (4 - 5)
3. The items are an accurate reflection of the underlying construct (PEHH)	4 (3 - 5)	4 (4 - 5)
4. The items are overall relevant to the pediatric population	4 (4 - 5)	4 (4 - 5)

Consistency of Expert Responses from Round 2

Similar to round 1, we explored the consistency in expert responses focusing on differences between the "domain scores" and "global relevancy scores" (Page 20). Seventy-two score differences (9 domains *x* 8 experts = 72 response sets) were computed as a result of 8 experts providing an item-by-item review in round 2. The mean score difference was 14.9 ± 9.47 points, which is lower than the score difference in round 1 (16.1 ± 12.4). No response inconsistencies were identified, as the score differences were distributed within 2 SDs and therefore displayed less variance.

Unique item-level suggestions from the identified 'inconsistent' experts

Unique suggestions from the identified "inconsistent" experts #4 and #5 are highlighted in Appendix C along with the item-level agreement achieved for these questions/items. The suggestions we incorporated based on expert #4 received an item-level percent agreement of 88% after round 2 (with the exception of item 210 that received 63% agreement). Modifications that were accepted in part by suggestions from "inconsistent" experts #5 also had high item-level agreement. Despite the identified inconsistencies from expert #4 and #5, all of the suggestions (despite those requiring re-wording for further clarity) were carried forward to the final version. This indicates that the exploratory consistency check conducted using the scoring method was perhaps an added, non-mandatory step.

To make final modifications in part by the round 2 suggestions, we focused on improving question/item clarity and incorporating final requested additions. Of the total **118 suggestions** in round 2, we **accepted 84** and **rejected 34**. Reasons for rejection can be referred to in Appendix C. Fifty-three questions/items were re-worded, 25 added, and 11 deleted, resulting in **262 questions/items** in the final version (vF). A summary of suggested modifications, accepted modifications, and subsequent number of questions in each PEHH version is provided in Figure 7.

E.g. 248 questions/items (v2)
+ 25 questions
- 11 questions
= **262 questions in vF**

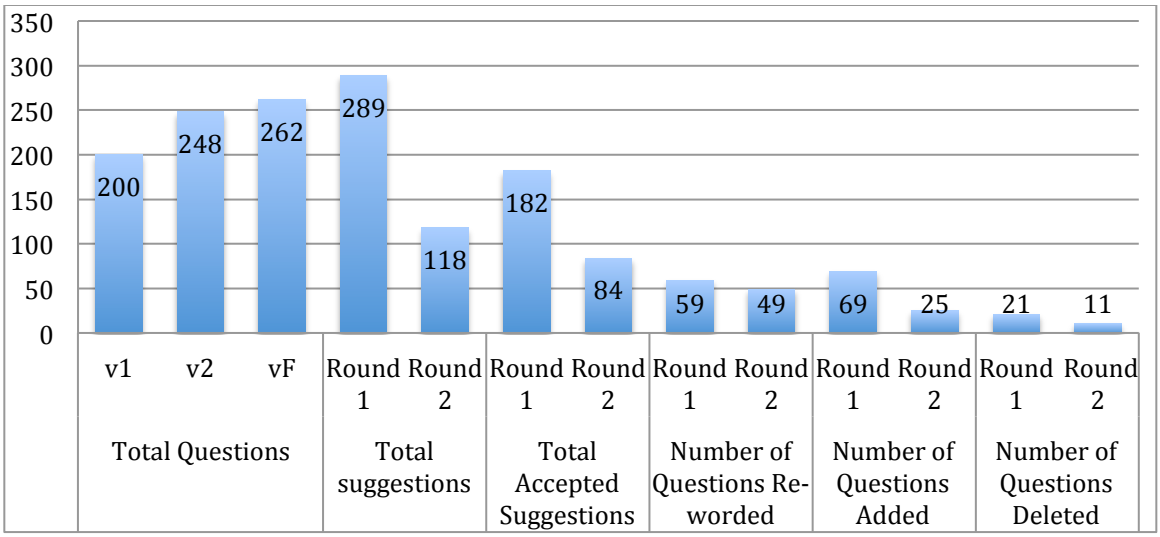

Figure 7. Summary comparison of the number of questions re-worded, added and deleted, and subsequent number of questions in v1, v2 and vF

Phase I PEHH Refinement

The majority of the questions in the PEHH required additional expansion for more detailed responses. Some questions are repeated throughout the PEHH, which gives clinicians a more comprehensive environmental history pertaining to the section of interest. Many questions may also only be explored depending on which sections are pertinent to the specific clinical case. In an effort to highlight the questions that create additional expansion, we re-numbered the questions, which led to further refinement. Each number represents a hypothetical, independent exposure. The subsequent alphabetical designations permit response expansion if the independent question/item yields "affirmative" responses. For example, if question #41 is positive (e.g. "yes"), then the subsequent questions will be explored further.

Item # 41: Does anyone in the child's life smoke? Yes No

41a): If yes, who are the smokers? _____

41b): How much do they smoke and how often? _____

41c): Where do they smoke? _____

41d): Do smokers wash hands or change clothes before interacting with the child?

Yes No

Re-numbering the questions resulted in a total of **161 independent questions/items**, with additional 101 subsequent options to permit a more in-depth exploration. Appendix F (Item Mapping) portrays the modifications that were made and the subsequent question numbering in each PEHH version. The final version is available in Appendix G.

The re-numbered questions/items (Appendix F) were reviewed to determine whether a final round of feedback was mandatory. Of the 25 questions that were added after round 2, 15 serve to collect more information encompassing the main exposure indicator question (e.g. permit a more in-depth exploration). The remainders of the modifications made after the second round were mainly with regards to improving item clarity rendering a final round of feedback non-mandatory.

Phase I Conclusions

Through the utilization of an iterative process, greater expert response homogeneity was achieved along with content improvement. Content improvement was indicated by an increase in Percent Agreement for 8/9 sections and a decrease in the response range for the global questions, which fall between 4 (agree) and 5 (strongly agree). All of the domains display excellent content validity, indicated by a Percent Agreement greater than 90%[30]. These two rounds allowed us to identify areas requiring content improvement while ensuring the inclusion of relevant and comprehensive questions/items to cover our respective sections/domains. Thus far, while we are confident that we have a relevant and comprehensive set of questions to explore pediatric environmental risk factors, the usability and usefulness of the questionnaire involving parents/guardians and pediatricians, respectively, still required assessment, which was carried out in the following phase. Future study recommendations will also discuss the need to assess PEHH internal consistency reliability, which is important for the described purposes of the PEHH.

Phase II: PEHH Usability and Usefulness Assessment

Objective

In an effort to further our process of establishing content validity, we aimed to pilot the Pediatric Environmental Health History and gather feedback from parents/guardians and pediatricians about its' usability and usefulness, respectively.

Phase IIA: PEHH Usability Assessment – Feedback from Parents or Guardians

Methods

Parent/guardian Participants

In Phase I of our study, environmental experts were relied on to judge the relevance and comprehensiveness of our content. Rather than receiving parent/guardian appraisal for each PEHH question/item, the parents/guardians were relied on to assess its usability by examining the ease of answering the questions, appropriateness of response options, question/item comprehension, and respondent burden[26]. Children were not included in assessing PEHH usability because they are anticipated to be too young and are not direct questionnaire respondents. Recruitment of the parents/guardians occurred in the waiting room of the Edmonton Child Health Clinic, Misericordia Hospital, in which they were initially informed of the study. Parents/guardians were eligible for inclusion as per the following inclusion and exclusion criteria:

Parent or Guardian Inclusion Criteria

1) Parents or guardians visiting the Child Health Clinic at the Misericordia Hospital with a child aged 18 years or less and with any health concern(s).

2) Parents or guardians who have not previously completed the PEHH questionnaire. If they have already completed one previously, we anticipated that they would not want another one for their record.

3) Parents or guardians who are reachable by phone for a telephone interview.

Parent or Guardian Exclusion Criteria

1) Parents or guardians with enough difficulties in the use of the English language precluding their active participation in a telephone interview.

2) Parents or guardians who have already completed the PEHH questionnaire prior to this visit. If they have already completed one previously, we anticipated that they would not want another one for their record.

3) Parents or guardians who do not have ready access to a telephone for the interview.

The PEHH was initially administered over the telephone and responses to all applicable questions and sections were captured and stored in the REDCap database[44]. To prevent any administrative bias, the PEHH questions were read directly as they appeared. Hard copies of the PEHH responses were then stored in the patient charts for future reference, if requested by the parents/guardians. Upon PEHH completion, a ten-question survey was telephone administered to parents/ guardians for them to assess its usability (Figure 8).

This usability survey was generated based on questions from previous studies aiming to assess the usability of their questionnaires[47-49]. The questions were thoroughly discussed by the environmental health team and slightly modified and adapted to capture important aspects of the PEHH. These aspects include its overall intent of exploring the environment, ability to provide environmental awareness, comprehension and ease of answering the questions, structure, response option appropriateness, environmental impact, and respondent burden

(Figure 8). The survey responses were coded on a scale of 1 to 4. The ambivalent "neutral" rating was excluded so that we could dichotomize the parents' or guardians' views as either satisfied or dissatisfied for more interpretable data[30]. The first 7 questions were based on an agreement scale and were coded: 1=strongly disagree, 2=disagree, 3=agree, and 4=strongly agree (Figure 8). Two additional questions about their satisfaction with the length of the PEHH and time taken to complete the PEHH were coded as: 1=very dissatisfied, 2=dissatisfied, 3=satisfied, and 4=very satisfied. Finally, we included one more question about their overall experience. This question was adapted from Dalal *et al*. (2011) and modified to a "satisfaction" response scale, as opposed to a scale ranging from 0 (terrible) to 10 (excellent) [48]. The parents/guardians were also given opportunity at the end of the survey to provide open comments/suggestions about the PEHH content or their experience[48] (Figure 8).

Please indicate your level of agreement for the following questions:				
1. The questionnaire did a good job of exploring your and your child's environment	Strongly Disagree	Disagree	Agree	Strongly Agree
2. This questionnaire allowed you to learn about your and your child's environment	Strongly Disagree	Disagree	Agree	Strongly Agree
3. The questions were easy to understand	Strongly Disagree	Disagree	Agree	Strongly Agree
4. The questions were easy for you to answer	Strongly Disagree	Disagree	Agree	Strongly Agree
5. The order of the questions flowed well	Strongly Disagree	Disagree	Agree	Strongly Agree
6. The response options were appropriate for this of questionnaire	Strongly Disagree	Disagree	Agree	Strongly Agree
7. The environment is an important influence in your and your child's health	Strongly Disagree	Disagree	Agree	Strongly Agree
Please indicate your level of satisfaction. How satisfied are you with:				
8. The length of the questionnaire	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied
9. The amount of time taken to complete the questionnaire	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied
10. Your overall experience with this questionnaire?	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied
11. Open-ended comments/suggestions: Are there any questions you feel we missed and should be included in the questionnaire?				

Figure 8. Usability survey for parents or guardians

PEHH Usability Data Analysis

The collected surveys were categorized and analyzed according to the child's condition. Three categories were of interest as a result of the most commonly encountered conditions at the Child Health Clinic:

1) Respiratory condition (can include conditions such as asthma).
2) Neurodevelopmental condition (can include conditions such as autism, attention deficit disorder or developmental delay).
3) "Other" (can include parents or guardians with children who come to the clinic with any other concerns/symptoms or for child routine checkup).

We aimed to include a minimum of at least ten cases in each condition category, and therefore a total of at least 30 complete survey samples. It is suggested that in questionnaire development, the number of patients is not as critical as the quality of the interview and diversity of patients included in the sample[29]. By including at least ten samples in each condition category, we aimed to gather usability feedback from a diverse group of parents/guardians.

The median rating was determined for each usability question and analyzed by condition category. The lowest achievable median rating for each question would be 1 and the highest would be 4. Higher ratings indicate greater parent/guardian agreement and satisfaction with the different aspects of the PEHH, as described. The open-ended comments/suggestions were then categorized into specific themes using Bright Future Guidelines, which is an initiative that aims to "address the health needs of children within a family and community context"[50]. This initiative provides various resources for health providers and parents to facilitate the care of their children from infancy through adulthood, and was used by Garbutt *et al.* (2012) to categorize the identified child health problems that were of parental concern[2].

Ethics

The University of Alberta Human Research Ethics Board granted ethics approval for this study (Pro00031023), and Covenant Health Research Centre (CH Study

#1363) granted site approval. The parent information sheet and consent form can be found in Appendix H.

Results

General Characteristics

A total of 44 parents/guardians completed both PEHH and usability surveys. Twenty, eleven, and fourteen samples were categorized as "other", "respiratory", and "neurodevelopmental" conditions, respectively. Since one patient displayed both a respiratory and neurodevelopmental condition (asthma and attention deficit disorder), the questionnaire responses were analyzed as a part of both categories. The respiratory category consisted of conditions including asthma and shortness of breath or stamina. The neurodevelopmental category included conditions such as developmental delay, spatial and visual concerns, attention deficit hyperactive disorder, post-traumatic stress disorder, anxiety, depression, bipolar disorder, schizophrenia, and expressive language disorder. The "other" category included child routine check-ups, dermatitis, otitis media, eczema, fever, acute urinary tract infections, gastrointestinal symptoms, and mothers visiting the breastfeeding clinic.

The average parent/guardian age, child age, and time taken for PEHH completion for the total sample population and by condition category can be referred to in Table 12. The average age of the parents/guardians (n=44) was 35.11 ± 7.02 years (Table 12). The average child age was 6.13 ± 5.26 years, and the average time taken to complete the PEHH was 28.89 ± 6.17 minutes (Table 12). When analyzed based on condition category, the average age of parents/guardians was slightly lower for those in the "other" category (29.81 ± 6.52) compared to those in the respiratory and neurodevelopmental categories (39.44 ± 4.62 and 42.15 ±7.46, respectively, Table 12). Most of the children in the "other" category were newborns visiting the breastfeeding clinic or young children needing a routine check-up. These children were in general younger than those in the respiratory and neurodevelopmental categories (Table 12).

Table 12. Mean age of respondents, their children, and time for PEHH completion

		Mean (SD)
Total (n=44)*	**P/G Age (years)**	35.11 (±7.02)
	Child Age (years)	6.13 (±5.26)
	Time (minutes)	28.89 (±6.17)
"Other" (n=20)	**P/G Age (years)**	29.81 (±6.52)
	Child Age (years)	2.47 (±2.87)
	Time (minutes)	28.90 (6.00)
Respiratory (n=11)	**P/G Age (years)**	39.44 (±4.62)
	Child Age (years)	10.04 (±3.68)
	Time (minutes)	31.09 (±7.92)
Neurodevelopmental (n=14)	**P/G Age (years)**	42.15 (±7.46)
	Child Age (years)	9.65 (±5.49)
	Time (minutes)	33.54 (±6.25)

*One sample presented both respiratory and neurodevelopmental conditions. This sample was therefore analyzed separately within the respiratory and neurodevelopmental categories.

Survey Responses

The median ratings were determined to be either 3 or 4 ("agree to strongly agree", or "satisfied to very satisfied"), for each usability question (Table 13). Only one parent/guardian with a child in the "other" category was not satisfied with the time taken to complete the PEHH, length of the PEHH, and her overall experience, as she indicated too much respondent burden. Two parents/guardians felt that the PEHH did not allow them to learn about their and their child's environment and did not do a good job of exploring their environment. In the "respiratory" category, only one parent/guardian was dissatisfied with the length of the questionnaire. Finally, in the "neurodevelopmental" category, only two parents/guardians felt that the PEHH did not allow them to learn about theirs and their child's environment.

Table 13. Median ratings for each survey question, by condition category

Please indicate your level of agreement for the following questions: (1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree)			
	Other (n=20)	Respiratory (n=11)	Neurodevelopmental (n=14)
	Median Rating (Range)	Median Rating (Range)	Median Rating (Range)
1. The questionnaire did a good job of exploring your and your child's environment	4 (2 - 4)	4 (3 - 4)	3 (2 - 4)
2. This questionnaire allowed you to learn about your and your child's environment	3 (2 - 4)	3 (2 - 4)	3 (2 - 4)
3. The questions were easy to understand	3 (3 - 4)	4 (3 - 4)	3 (3 - 4)
4. The questions were easy for you to answer	3 (3 - 4)	4 (3 - 4)	3 (3 - 4)
5. The order of the questions flowed well	3 (3 - 4)	4 (3 - 4)	3 (3 - 4)
6. The response options were appropriate for this of questionnaire	3 (2 - 4)	4 (3 - 4)	3 (3 - 4)
7. The environment is an important influence in your and your child's health	4 (3 - 4)	4 (3 - 4)	4 (3 - 4)
Please indicate your level of satisfaction for the following questions: How satisfied are you with: (1=Very dissatisfied, 2=Dissatisfied, 3=Satisfied, 4=Very satisfied)			
8. The length of the questionnaire	3 (2 - 4)	3 (2 - 4)	3 (3 - 4)
9. The amount of time taken to complete the questionnaire	3 (2 - 4)	3 (3 - 4)	3 (3 - 4)
10. Your overall experience with this questionnaire?	3 (2 - 4)	4 (3 - 4)	3 (3 - 4)

The open-ended comments/suggestions provided by parents/guardians can be referred to in Figure 9. Themes that emerged from the parents/guardians include: environmental (e.g. cleanliness), environmental (e.g. pollution), environmental (general), lifestyle, medical, risky behavior, physical activity, development, and diet during pregnancy (Figure 9). Seventeen parents/guardians did not identify any new themes to be further explored in the PEHH and felt that it was fully comprehensive.

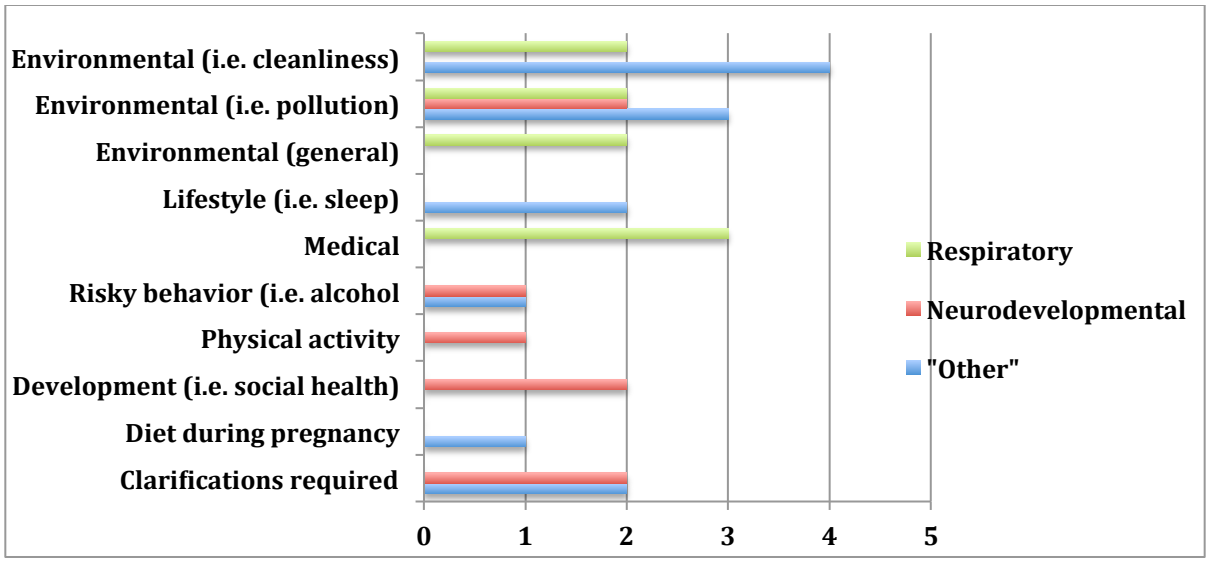

Figure 9. Comments/suggestions from Parents/guardians (n=44 P/G)

Specific open-ended comments or suggestions are described as follows. From the "respiratory" category, one parent/guardian suggested exploring what the children play with outside (general environment), and one suggested exploring more about farming behavior. One parent/guardian thought it was important to include questions about immunizations and their association with the condition of interest. However, since this aspect is covered in the patient's medical history, it was not included in the environmental history. One parent/guardian suggested exploring cleanliness of their child's bedroom (environmental cleanliness). However, this is already indicated by the specific question about general frequency of "dusting" in the section involving environmental exposures associated to respiratory symptoms. Finally, one parent/guardian was curious about the interaction of certain medications (medical) with the environment. However, from the clinical point of view, interactions can be explored through utilizing the PEHH in conjunction with the patient's medical history. Therefore, specific questions about medication interactions were not included.

From the "neurodevelopmental" category, one parent/guardian suggested exploring more smoking and alcohol exposures (risky behavior) as apart of the family's lifestyle. One parent/guardian suggested exploring how much exercise their child gets and their social environment (physical activity and social health

development, respectively). One parent/guardian was curious about the significance of *many* trees in the yard (environmental pollution), and one suggested more questions regarding living in proximity to power plants (environmental pollution), especially if the child lived in the vicinity of power plants for the first few years of life. These aspects of the child's environment are currently explored throughout various sections of the PEHH, rendering further modification unnecessary. For example, smoking behavior and proximity to power plants are explored in the General Environment, School Environment, Daycare Environment, and Prenatal Exposures sections. Alcohol problems can be addressed in the Lifestyle section by indirectly asking the respondent whether there is something causing stress/grief for the family. Various questions in the PEHH also indirectly explore physical activity, thereby rendering it unnecessary to include an explicit exercise question. Likewise, these indirect questions are already available to allow the PEHH administrator to retrieve necessary environmental information without being too intrusive.

From the "other" category, three parents/guardians suggested exploring sterilization (environmental cleanliness) of their children's toys (e.g. at home, daycare, and extracurricular activities). However, this was not included in the PEHH since it involves exploring vectors for contracting infectious diseases that can be determined through a routine medical history check. Two parents/guardians wanted the PEHH to explore how much sleep the baby and family are getting (lifestyle). Two were curious about pesticide spray in the parks (environmental pollution) and one was curious about the significance of *old* trees in the yard (environmental pollution). Finally, one parent/guardian suggested exploring more about family alcohol problems (risky behavior) (Figure 9).

Four parents/guardians required clarifications for questions that were difficult to understand (Figure 9). For example, one with a child in the neurodevelopmental category required clarification for question #19: "Are you concerned about any environmental exposures/issues", as they did not understand what we meant by the "environment". Another parent/guardian with a child in the

"neurodevelopmental" category had difficulty understanding question #229: "Is there anything you feel might make your child's respiratory symptoms worse", since their child did not display any respiratory symptoms. We therefore needed to specify the symptoms of interest, such as a seasonal cough or runny nose. One parent/guardian with a child in the "other" category suggested we include an "I don't know" response option for question #200: "Are your furnace and ducts well maintained". Finally, one parent/guardian with a child in the "other" category required us to provide examples of "harsh chemicals" in question #215, as they were not well informed of what constitutes a "harsh" chemical environment.

Phase IIB: PEHH Usefulness Assessment – Pediatrician Feedback

Methods

Pediatrician Participants

Our target population consisted of Edmonton pediatricians and clinical fellows throughout the Department of Pediatrics, University of Alberta. Potential participants were identified using an academic contact list provided by the department, and were invited to participate in completing an online survey through REDCap[44] upon PEHH review. The identified pediatricians and clinical fellows represented different pediatric specialties, including Dermatology, General Pediatrics, Hospitalists, Neonatal Intensive Care Unit, Neurodevelopmental, Cardiology, Emergency, Endocrinology, Gastroenterology, Infectious diseases, Nephrology, Neurology, Respirology, and Rheumatology. To increase our pool of potential participants, community pediatricians from across Canada were also invited to participate via the Canadian Pediatric Society Community Section e-forum. These private e-forums are available to members to facilitate discussions and the sharing of information.

Upon agreeing to take part in the study, participants received the usefulness survey with the PEHH attached, via REDCap[44]. Focus groups are often used to obtain information on "how groups of individuals think or feel about a particular topic"[51]. However, we feel that a structured survey would be more appropriate to assess the usefulness of the PEHH and to characterize the response patterns, as opposed to an open-ended discussion. Given the limited time frame of our study, we aimed to gather feedback from at least 10-15 Pediatricians, or until the information gathered produced little or no change to the data[52]. Various studies suggest that this range is considered sufficient in receiving feedback depending on the topic of interest[53-56].

A few of the survey questions were adapted from a survey used in a study by Kilpatrick *et al*. (2010), which aimed to assess pediatrician beliefs about the

Pediatric Environmental History[22]. Our survey responses were coded on a scale of 1 to 4, with the first eight questions on an agreement scale, and the last two questions on a satisfaction scale, similar to that of the usability survey (Figure10). Participants were also asked to provide their open comments/suggestions about the PEHH content and/or its usefulness for the clinical setting[53, 54] (Figure 10).

Please indicate your level of agreement for the following questions:				
1. The PEHH is useful to explore the environment of children and their parents/guardians (P/G)	Strongly Disagree	Disagree	Agree	Strongly Agree
2. The PEHH can give P/G more awareness about the environment and it's role in their child's health	Strongly Disagree	Disagree	Agree	Strongly Agree
3. The questions are clear enough for Pediatricians to ask	Strongly Disagree	Disagree	Agree	Strongly Agree
4. The questions are clear enough for P/G to understand	Strongly Disagree	Disagree	Agree	Strongly Agree
5. The order of the questions flow well	Strongly Disagree	Disagree	Agree	Strongly Agree
6. The response options are appropriate for the PEHH	Strongly Disagree	Disagree	Agree	Strongly Agree
7. The role of the environment in children's health is of great importance	Strongly Disagree	Disagree	Agree	Strongly Agree
8. The PEHH is valuable to clinical Pediatric practice	Strongly Disagree	Disagree	Agree	Strongly Agree
Please indicate your level of satisfaction. How satisfied are you with:				
9. The length of the PEHH	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied
10. The amount of time anticipated to administer the PEHH	Very dissatisfied	Dissatisfied	Satisfied	Very satisfied
OPEN ENDED COMMENTS/SUGGESTIONS				

Figure 10. Usefulness Survey for Pediatricians

PEHH Usefulness Data Analysis

For the survey questions, the lowest achievable rating is 1 and the highest is 4. The median ratings were determined for each question comprising the survey. Higher ratings are indicative of greater agreement and satisfaction with various aspects of the PEHH regarding its' usefulness. Their open-ended comments/suggestions were also analyzed to explore their response patterns.

Results

General Characteristics

A total of 178 Pediatricians and 39 clinical fellows were identified throughout the Department of Pediatrics. Within the study time frame, we received fifteen complete surveys, of which 9 were from pediatricians in the department, and one was from a clinical fellow. Of the community pediatricians invited through e-forum, we received only five complete survey responses. The participants represented various pediatric disciplines including general, developmental, cardiology, emergency, behavioral, respirology, neonatal intensive care, academic, and community.

Survey Responses

The median ratings for each usefulness question can be referred to in Table 14. The pediatricians agreed with all of the usefulness questions, indicated by a median rating of 3 (agree) or 4 (strongly agree, Table 14). Only one pediatrician was dissatisfied with the response options, and one was dissatisfied with the order of the questions, further suggesting shifting the Prenatal Exposures section directly after the General Information section. Ten pediatricians were dissatisfied with the length of the PEHH, and 11 were dissatisfied with the anticipated time for completion, indicated by a median rating of 2 (dissatisfied) for both questions (Table 14).

Table 14. Median rating for each PEHH "usefulness" question (n=15 pediatricians)

Please indicate your level of agreement for the following questions: (1 = strongly disagree, 2=disagree, 3=agree, 4= strongly agree)	Median Rating (Range)
1. The PEHH is useful to explore the environment of children and their parents/guardians (P/G)	3 (3 – 4)
2. The PEHH can give P/G more awareness about the environment and it's role in their child's health	3 (3 – 4)
3. The questions are clear enough for Pediatricians to ask	3 (3 – 4)
4. The questions are clear enough for P/G to understand	3 (2 – 4)
5. The order of the questions flow well	3 (2 – 4)
6. The response options are appropriate for the PEHH	3 (2 – 4)
7. The role of the environment in children's health is of great importance	4 (3 – 4)
8. The PEHH is valuable to clinical Pediatric practice	3 (3 – 4)
Please indicate your level of satisfaction. How satisfied are you with: (1=very dissatisfied, 2=dissatisfied, 3= satisfied, 4= very satisfied)	
9. The length of the PEHH	2 (2 – 4)
10. The amount of time anticipated to administer the PEHH	2 (1 – 4)

Figure 11 displays the different open-ended comments/suggestions provided by the pediatricians. It was recognized by 4 participants that pediatric environmental health is a very important issue. However, a commonly encountered concern was that the PEHH is too long for application in a busy clinical environment (n=10) and four participants recommended that a shorter version would be beneficial. Despite this, six suggested that the PEHH was very comprehensive and contained great detail, and one commented that there were a lot of interesting and thought provoking questions. Four pediatricians in general indicated a concern that certain questions might "lead to parental concerns beyond what they started with" such as the questions about seafood intake and dental work done during pregnancy. Three participants were also concerned that they would not know what to do with the gathered information. Only one participant identified that this questionnaire

would definitely help to increase environmental awareness. One pediatrician was concerned that the parents/guardians would have difficulty finding the time to complete such a comprehensive questionnaire, and two suggested that the PEHH would be more appropriate for a subspecialty environmental health clinic. Other comments included a suggestion that a preface about the intended purpose of the PEHH be included to assure respondents that they are not being stigmatized if their responses highlight potential exposures (Figure 11). Two pediatricians did not provide any open-ended comments/suggestions.

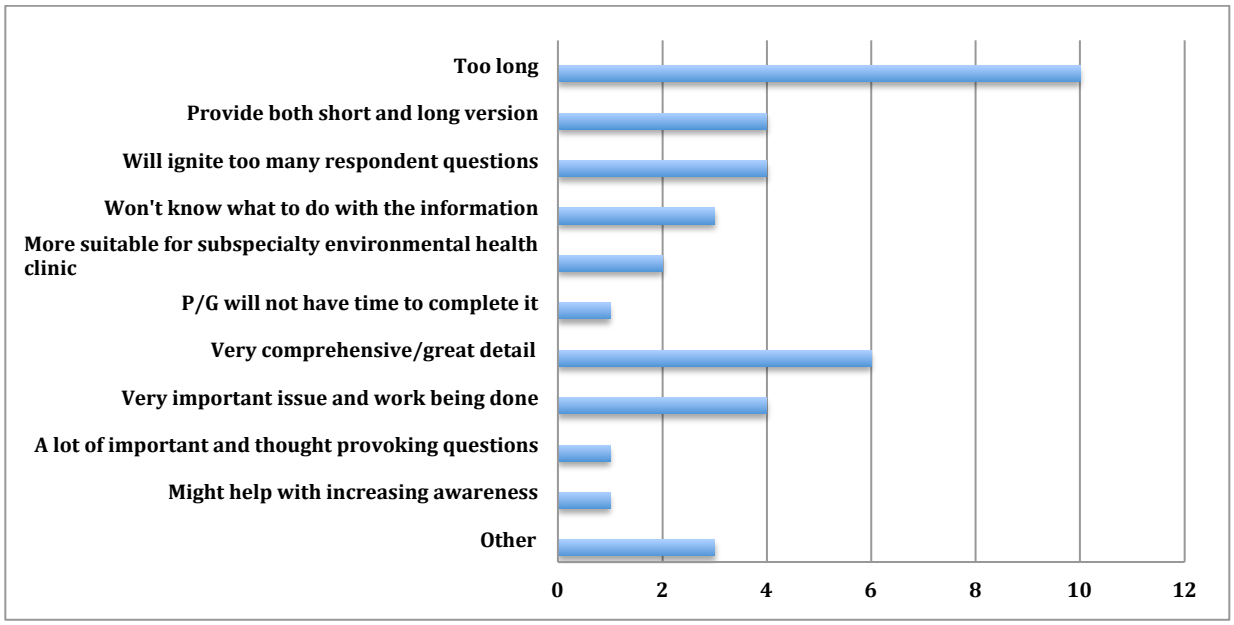

Figure 11. Open-ended comments/suggestions from pediatricians (n=15 pediatricians)

Phase IIA and IIB Conclusions

Both parents/guardians and pediatricians overall indicate agreement with different aspects regarding the usability and usefulness of the PEHH, respectively. However, there appears to be a discrepancy in their views regarding their level of satisfaction with the time/anticipated time required to complete the PEHH, and its length. Parents/guardians are satisfied with the length of the questionnaire and their devoted time in completing it. Pediatricians indicate dissatisfaction with the length and the anticipated time for administration. However, it is not clear as to whether the anticipated administration time is with regards to the time anticipated for them to administer the questionnaire or the respondent's time devoted to completing it. At this point we would like to emphasize that provided a busy clinical setting, the PEHH is meant for administration by a clinical assistant (e.g. nurse) rather than by the pediatricians.

Discussion

A wide variety of questionnaires are used in clinical settings, however, the quality of the data collected could be compromised if these questionnaires have not been formally validated. Systematic reviews in various disciplines have identified that very few questionnaires have been validated[16-18] and in addition to this, the use of validated questionnaires is substantially low[18].

Children's environmental health is an emerging discipline. The associations of environmental hazards with various children's health outcomes are receiving increasing interest. Although questionnaires exploring environmental risk factors are available[13, 20], they are limited in their measurement scope and more importantly; their measurement properties have not been examined sufficiently, properly, or comprehensively examined[20]. In general, measurement properties of a questionnaire provide information about the questionnaire's consistency, accuracy, and ability to detect change over time[18]. Content validity is considered one of the most important measurement properties and testing other measurement properties will not replace content validity[27]. Once content validity for a questionnaire has been established, other measurement properties should be assessed to further strengthen its credibility and ultimately its clinical use.

Our study undertook a fundamental step in formally evaluating a questionnaire developed to clinically explore environmental risk factors for the pediatric population. The objective of this project was to apply the Terwee (2007) criteria[27] to establish the content validity for the Pediatric Environmental Health History (PEHH). To do this, we engaged a) a panel of experts using an iterative process (objective 1) in which "content validity" was achieved for the relevance of the questions in each section and overall agreement was achieved per section regarding its comprehensiveness, and b) parents/guardians to assess the questionnaire's usability (objective 2.a.) in which agreement and satisfaction was achieved for its ease in answering questions, comprehension, and respondent burden. Parents were generally optimistic with the usability aspects of the PEHH

and satisfied with the time they devoted. Lastly, we retrieved feedback from pediatricians (objective 2.b.), which allowed us to gain a better understanding about the applicability of the measure in clinical settings. We found that although pediatricians were generally optimistic about the overall usefulness of the PEHH, they found it to be lengthy and anticipated too much time commitment for a busy clinical practice.

Utilizing an iterative approach for obtaining expert judgment, we were able to achieve excellent expert consensus on the PEHH sections after two rounds. The Delphi technique is commonly used to achieve consensus from a panel of experts about a topic of interest[32, 33]. Strengths of using this modified Delphi technique in this study were that we ensured participant anonymity by hiding their identification from one another. We also controlled the feedback that was given back to the participants for another round of review. An apparent limitation in this step did not allow the experts opportunity to vote on the rejected items, potentially leading to some selection bias during the team discussion. Although this limitation may have compromised the rigor that is otherwise necessary for the Delphi technique, the selection of our items to incorporate in the subsequent rounds was driven by predetermined criteria. These criteria ensured protection against individual biases that may have occurred within the team. Another strength of our modified Delphi technique was that data retrieved from the experts was analyzed through determining expert consensus. This process in conjunction with specific criteria for "excellent content validity" allowed us to determine how many rounds of review were required[17, 32, 33]. We were also able to use the consensus achieved as a measure of content improvement and determine areas posing further difficulty.

The Percent Agreement achieved in round 1 suggested high response subjectivity and a need for content improvement. Despite that excellent expert consensus was achieved after the second round, the experts identified a few areas requiring further improvement (mainly re-wording), which we took into consideration in

creating the final version. Although a final round of thorough item review or even a global appraisal of the final version would have been beneficial, it was not mandatory provided the nature of the responses received in round 2. We found that majority of these suggestions were directed towards improving question/item clarity. Also, questions/items that were added for the final version mainly affected the format and style of the questions to collect more detailed information encompassing the main 'exposure indicator questions'.

Limitations in the available data repository also prevented us from identifying the total number of environmental health experts globally. This forced us to rely on established clinical contacts that were affiliated with the WHO and mainly PEHSU members, which may have resulted in some selection bias. Previous studies also indicate that pediatricians are largely unaware of the PEHSUs and that hardly any refer their patients to the specialty[23, 24]. As children's environmental health is an emerging discipline, a precise data directory of experts appears to be currently unavailable and we further suspect that the actual number of *pediatric* environmental health experts on an international level is substantially low. For the purpose of our study however, despite the small sample of environmental experts participating, our criteria allowed us to ensure the selection of a homogeneous group of participants (e.g. those who represent the same general discipline area of interest), thus giving credibility to our experts[33, 59].

Within the second phase of our study an important finding emerged from our data, which was a discrepancy in the views of the questionnaire respondents (parents/guardians) and the pediatricians regarding the length of the PEHH and the time/anticipated time for administration. It appears that parents/guardians are willing to spend their time on answering environmental questions, which they also feel are important influences in their and their child's health. Pediatricians however, are less satisfied with the anticipated administrative burden despite their belief that pediatric environmental health is important. The average time taken for parents/guardians to complete the questionnaire was approximately 30 minutes.

There was also a large variation in the time, displayed by minimum and maximum times taken for completion as 21 and 49 minutes, respectively. This is because more complicated cases may necessitate more time for in-depth exploration, whereas less complex cases may require less time for completion. The modes of administration[60] for any questionnaire must also be taken into account as in reality direct clinical interviews might even take a longer time to conduct. This may even explain the reason pediatricians are dissatisfied with the anticipated time it would take to conduct a history, despite their optimism towards the importance of environmental impacts on children's health.

Pediatricians expressed a similar attitude in previous studies indicating that the environmental history would in general take up too much time, despite their overall optimism towards environmental health[22-24]. However, there does appear to be a slight discrepancy in the results from these studies as time seems to be more of an issue for certain pediatrician populations over others. The Georgia pediatrician population[22] (n=267) provided an average rating of 3.11 ± 0.93, compared to the Wisconsin[23] (n=267) and New York [24] (n=277) populations, who gave lower average ratings of 2.49 ± 1.01 and 2.51 ± 1.04, respectively (higher ratings indicate a greater belief that time is a burden). Reasons for these discrepancies should be explored. At this point in our study, it is not clear as to whether pediatricians feel that the user-friendly aspect of our questionnaire is more of an issue for themselves or for their patients, but despite this, the request for a shorter version can help to qualify the discrepancy found between the two groups. None of the studies examined whether pediatricians would be more likely to implement the environmental history in clinical practice, provided a shorter version. Our data provides opportunities to address this in future studies.

In the first phase of the study, we achieved a comprehensive set of items and did not conduct item reduction. It has been suggested that conducting item reduction at this stage does not guarantee a better content validity and is therefore, not mandatory[27]. However, provided the responses from the pediatricians regarding its

length, opportunity for creating a 'shorter', user-friendlier version should be explored. If opportunity does exist, future studies should focus on using item reduction techniques (e.g. exploratory and confirmatory factor analyses) to create a shorter version.

Implications for practice

Children's environmental health is a growing discipline and pediatricians recognize the importance of environmental impacts on children's health. In order to facilitate an exploration of these environmental impacts, we undertook an imperative validation step to ensure that a relevant and comprehensive set of questions were established. Our study results indicate that although parents/guardians are satisfied with the length and time taken for completion, pediatricians feel the opposite. Therefore, an important step in encouraging clinical use of the PEHH in the future may require the need for a shorter version. Future studies also however, need to examine whether a shorter version would be more likely to be implemented in clinical practice if provided. Promoting recognition of the environmental specialty is a fundamental step in further developing the children's environmental health discipline. Having necessary tools, especially a questionnaire that has undergone content validity can facilitate this promotion.

Implications for future research

The development of any measurement instrument (e.g. questionnaire) is an iterative process[29] and does not stop once content validity has been established. Future research should consider identifying questions that provide the most useful information in order to a) conduct item reduction, b) establish discriminative and predictive construct validity, and c) determine reliability. Data should be collected from a larger sample size and preferentially undergo both exploratory and confirmatory factor analyses to identify 'factors' that explain the variance in the observed responses[61]. Reducing the items would lead to better applicability of this instrument in clinical settings. Cross-sectional discriminative validity and predictive validity should also be established using a hypothesis-testing approach

(e.g. confirming *a priori* hypotheses devised for each condition group of interest). It is also important for internal consistency reliability to be examined, focusing on the association between the responses to questions/items within the questionnaire or the individual domains.

Conclusions

The need for validated questionnaires is an important requirement for clinical practice and various areas of health research. Children's environmental health is no exception. Questionnaires that have not undergone a formal evaluation can compromise the validity of the data collected. Through following recommended guidelines, initial support for content validity has been established, ensuring a relevant and comprehensive set of items to clinically explore environmental risk factors for the pediatric population. Specific findings were as follows:

- Using a modified Delphi technique, pediatric environmental health experts reached excellent consensus for the relevancy of the questions to their respective sections, and indicated agreement with their overall comprehensiveness.
- Parents/guardians overall indicate agreement with the questionnaire's comprehension, ease of answering questions, appropriateness of response options, and satisfaction with their time commitment and length of the questionnaire.
- Pediatricians indicate overall agreement for various aspects regarding the questionnaire's usefulness, despite their dissatisfaction with its length and the anticipated administration time outside of a specialized pediatric environmental health clinic.

Future studies should establish other measurement properties, namely construct validity and reliability of the data collected. Creating a shorter version should also

be explored, as this may be more favorable for clinical implementation outside a specialized pediatric environmental health clinical setting.

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Appendix A

Original Pediatric Environmental Health History (200 questions/items)
*Note: The section General Environment for Second Household was not included in the initial question/item count.

Pediatric Environmental Health History (PEHH) Questionnaire

Questions in shaded areas are for clinical staff use ONLY

Demographics

1. Date form filled _____

5. Gender ☐ Male ☐ Female

6. Date of birth _____

7. Who initiated visit to PEHSU _____

8. Mother's country of origin _____

9. Years in Canada _____

10. Marital Status
☐ Never legally married
☐ Legally married (and not separated)
☐ Separated, but still legally married
☐ Divorced
☐ Widowed
☐ Living with a common law partner

11. Has your child lived in another country? ☐ Y ☐ N

12. Name of country _____

14. Your child has experiences symptoms for (weeks) _____

15. Are you concerned about any environmental factors/issues? _____

16. Does he/she have any underlying conditions? ☐ Y ☐ N

18. How many people in the household? _____

19. Any with similar symptoms? ☐ Y ☐ N

20. Which extended family members have or had similar symptoms/conditions as your child? _____

22. Any other blood relatives with this same condition? ☐ Y ☐ N

23. If yes, please specify who _____

General Environment

24. Does the child live in more than one household? ☐ Y ☐ N

25. (any details) _____

26. Describe the location of your home ☐ city ☐ rural

27. (any details) _____

28. Do you rent or own ☐ rent ☐ own

29. Age of home > 30 years? ☐ Y ☐ N

30. Is there heavy traffic within 300 meters of your home including stop light, 4-way stop, idling school buses? ☐ Y ☐ N

31. Is there a gas station or dry cleaner within 300 meters of your home? ☐ Y ☐ N

32. Check all that apply:
☐ gas station
☐ dry cleaner

33. Are there nearby farms, parks, golf courses or school yards within 300 meters of your home? ☐ Y ☐ N

34. Check all that apply:
☐ farms
☐ parks
☐ golf courses
☐ school yards

35. Are there: Industry, emissions, coal fuelled power plants within 5 kilometres of your home? ☐ Y ☐ N ☐ I don't know

36. Any pesticides used in home/yard? ☐ Y ☐ N

37. Have you moved in the past year? ☐ Y ☐ N

38. (If so, check all that apply)
☐ your last home was > 30 years
☐ heavy traffic near home
☐ near gas station
☐ near dry cleaners
☐ near farms
☐ near golf courses
☐ near school
☐ near industry/emissions

39. Have you renovated, added new carpets, paint, floor coverings, floor finishings in the past year? ☐ Y ☐ N

40. If yes, check all that apply:
☐ added new carpets
☐ paint
☐ floor coverings
☐ floor finishings

41. (any details) _____

42. Do you know of any noticeable: peeling paint/water damage/mould that has occurred in your home? ☐ Y ☐ N

43. If yes, check all that apply
☐ peeling paint
☐ water damage
☐ mould

44. (any details) _____

45. Do you use a wood fireplace or wood burning stove? ☐ Y ☐ N

46. If yes, check all that apply
☐ wood fireplace
☐ wood burning stove

47. Gas fireplace, gas stove or gas dryer, propane use? ☐ Y ☐ N

48. If yes, check all that apply
☐ gas fireplace
☐ gas stove
☐ gas dryer
☐ propane

49. Does anyone in the child's life smoke? ☐ Y ☐ N

50. How many smokers in the household? _____

51. Indoor or outdoor smoking? ☐ indoor ☐ outdoor ☐ both

52. Are there pets at home? ☐ Y ☐ N

General Environment for Second Household (if applicable)

53. Describe the location of your home ☐ city ☐ rural

54. (any details) _____

55. Do you rent or own ☐ rent ☐ own

56. Age of home > 30 years? ☐ Y ☐ N

57. Is there heavy traffic within 300 meters of your home including stop light, 4-way stop, idling school buses? ☐ Y ☐ N

58. Is there a gas station or dry cleaner within 300 meters of your home? ☐ Y ☐ N

59. If yes, check all that apply
☐ gas station
☐ dry cleaners

60. Are there nearby farms, parks, golf courses or school yards within 300 meters of your home? ☐ Y ☐ N

61. If yes, check all that apply
☐ farms
☐ parks
☐ golf courses
☐ school yards

62. Are there: Industry, emissions, coal fuelled power plants within 5 kilometres of your home? ☐ Y ☐ N ☐ I don't know

63. Any pesticides used in home/yard? ☐ Y ☐ N

64. Have you moved in the past year? ☐ Y ☐ N

65. If so, check all that apply

- ☐ your last home was > 30 years
- ☐ heavy traffic near home
- ☐ near gas station
- ☐ near dry cleaners
- ☐ near farms
- ☐ near golf courses
- ☐ near school
- ☐ near industry/emissions

66. Have you renovated, added new carpets, paint, floor coverings, floor finishings in the past year? ☐ Y ☐ N

67. If yes, check all that apply

- ☐ renovate
- ☐ added new carpets
- ☐ paint
- ☐ floor coverings
- ☐ floor finishings

68. (any details) _____

69. Do you know of any noticeable: peeling paint/water damage/mould that has occurred in your home? ☐ Y ☐ N

70. If yes, check all that apply

- ☐ peeling paint
- ☐ water damage
- ☐ mould

71. (any details) _____

72. Do you use a wood fireplace or wood burning stove? ☐ Y ☐ N

73. If yes, check all that apply

- ☐ wood fireplace
- ☐ wood burning stove

74. Gas fireplace, gas stove or gas dryer, propane use? ☐ Y ☐ N

75. If yes, check all that apply

- ☐ gas fireplace
- ☐ gas stove
- ☐ gas dryer
- ☐ propane

76. Does anyone in the child's life smoke? ☐ Y ☐ N

77. How many smokers in the household? _____

78. Indoor or outdoor smoking? ☐ Indoor ☐ Outdoor ☐ Both

79. Are there pets at home? ☐ Y ☐ N

School Environment

80. Age of building > 30 years? ☐ Y ☐ N

81. Is it within 300 meters of heavy traffic including stop light, 4-way stop or idling school buses? ☐ Y ☐ N

82. Is there a gas station or dry cleaner within 300 meters of the building? ☐ Y ☐ N

83. If yes, check all that apply

- ☐ Gas station
- ☐ Dry Cleaners

84. Are there nearby farms, parks, golf courses or school yards within 300 meters of the building? ☐ Y ☐ N

85. If yes, check all that apply
☐ Farms
☐ Parks
☐ Golf courses
☐ School yards

86. Are there: Industry, emissions, coal fuelled power plants within 5 kilometres of the building? ☐ Y ☐ N ☐ I don't know

87. Any pesticides used inside or in the yard of care building? ☐ Y ☐ N

88. Are there carpets in the classroom? ☐ Y ☐ N

89. Are classrooms in a portable? ☐ Y ☐ N

90. Do you know of any renovation, including adding new carpets, paint, floor coverings, floor finishings in the past year? ☐ Y ☐ N

91. If yes, check all that apply
☐ New carpets
☐ Paint
☐ Floor coverings
☐ Floor finishings

92. (any details) _____

93. Describe the location of the school ☐ City ☐ Rural

94. (any details) _____

95. Are there pets in school? ☐ Y ☐ N

Daycare/Day Home Environment

96. Does your child attend daycare or a babysitter? ☐ Y ☐ N

97. If yes, check all that apply
☐ Daycare
☐ Babysitter

98. Is the age of the care building > 30 years? ☐ Y ☐ N

99. Describe the location of the building ☐ City ☐ Rural

100. (any details) _____

101. Is it within 300 meters of heavy traffic including stop light, 4-way stop or idling school buses? ☐ Y ☐ N

102. Is there a gas station or dry cleaner within 300 meters of the building? ☐ Y ☐ N

103. If yes, check all that apply
☐ Gas station
☐ Dry cleaner

104. Are there nearby farms, parks, golf courses or school yards within 300 meters of the building? ☐ Y ☐ N

105. If yes, check all that apply
☐ Farms
☐ Parks
☐ Golf courses
☐ School yards

106. Are there: Industry, emissions, coal fuelled power plants within 5 kilometres of the building? ☐ Y ☐ N ☐ I don't know

107. Any pesticides used inside or in yard of care building? ☐ Y ☐ N

108. Do you know of any renovation, including adding new carpets, paint, floor coverings, floor finishings in the past year? ☐ Y ☐ N

109. If yes, check all that apply
☐ New carpets
☐ Paint
☐ Floor coverings
☐ Floor finishings

110. (any details) _____

111. Do any of the caregivers smoke? ☐ Y ☐ N ☐ I don't know

112. If yes, check all that apply
☐ Indoor
☐ Outdoor
☐ Both
☐ I don't know

Lifestyle

113. What is mom's occupation? _____

114. What is mom's parental age? _____

115. What is dad's occupation? _____

116. What is dad's parental age _____

117. What is the work setting? _____

118. Have these jobs changed in the past year? _____

119. (any details) _____

120. Have you completed:
☐ High school diploma or equivalent
☐ Registered apprenticeship or other trades certificate or diploma
☐ College, CEGEP, or other non-university diploma
☐ University certificate, diploma, or degree
☐ None of the above

121. Has the father received a diploma/certificate/degree? ☐ Yes ☐ No ☐ I don't know

122. Highest diploma/certificate/degree completed by the father: _____

123. Do you currently live in a lone parent family household? ☐ Y ☐ N

124. Have there been any issues causing ongoing or short term stress/grief? ☐ Y ☐ N

125. If so, how long? (please specify years or months) _____

126. Issue? _____

127. What hobbies or sports are the family members involved in? _____

128. What hobbies or sports does your child participate in? _____

129. Do you use hot tubs/swimming pools more than once per month? ☐ Y ☐ N

130. If yes, check all that apply
☐ Hot tubs
☐ Swimming pools

131. Approximately how many hours of TV does your child watch in one day? _____

132. Approximately how many hours on the computer does your child spend each day? _____

133. Does your child have a cell phone? ☐ Y ☐ N

Prenatal Exposures

134. Weeks of gestation at birth? _____

135. (if premature) Do you know why your child was premature? _____

136. Birth Weight? _____

137. Age of home > 30 years? ☐ Y ☐ N

138. Did you live within 300 meters of heavy traffic including stop light, 4-way stop or idling school buses? ☐ Y ☐ N

139. Was there a gas station or dry cleaner within 300 meters of your home? ☐ Y ☐ N

140. If yes, check all that apply
☐ Gas station
☐ Dry cleaner

141. Were there nearby farms, parks, golf courses, or school yards within 300 meters of your home? ☐ Y ☐ N

142. If yes, check all that apply
☐ Farms
☐ Parks
☐ Golf courses
☐ School yards

143. Were there: Industry, emissions, coal fuelled power plants within 5 kilometres of your home? ☐ Y ☐ N ☐ I don't know

144. Any pesticides used in home/yard? ☐ Y ☐ N

145. Mom's occupation? _____

146. (any details) _____

147. Dad's occupation _____

148. (any details) _____

149. Have you renovated, added new carpets, paint, floor coverings, floor finishings during pregnancy ☐ Y ☐ N

150. If yes, check all that apply
- ☐ Renovated
- ☐ Added new carpets
- ☐ Paint
- ☐ Floor coverings
- ☐ Floor finishings

151. (any details) _____

152. Did you smoke cigarettes? ☐ Y ☐ N

153. Did your husband smoke cigarettes? ☐ Y ☐ N

154. If yes, did he smoke inside or outside? ☐ Inside ☐ Outside ☐ Both

155. Did you have any illnesses during pregnancy? ☐ Y ☐ N

156. If yes, please specify _____

157. Did you use prescription medications? ☐ Y ☐ N

158. If yes, please specify _____

159. Any natural or Chinese herbs, supplements? ☐ Y ☐ N

160. Any recreational drug use? ☐ Y ☐ N

161. Alcohol? ☐ Y ☐ N

162. If yes, how frequent and how much? _____

163. Hobbies? _____

164. Risk from hobbies or sports? _____

165. Seafood/fish/sea mammals meals per month _____

Infancy/Childhood

166. How long was your child breast fed? (Please specify years or month) _____

167. Did your child use a soother or a bottle? ☐ Y ☐ N

168. If yes, check all that apply
- ☐ Soother
- ☐ Bottle

169. Has your child had any unusual dietary or feeding problems? ☐ Y ☐ N

170. If yes, please specify _____

171. How many cups of milk does your child drink per day? _____

172. Fast food meals per month? _____

173. Seafood/fish/sea mammals meals per month? _____

174. Does your child eat fruits and vegetables? ☐ Y ☐ N

175. Does your child eat a source of protein? ☐ Y ☐ N

176. (any details) _____

Respiratory Symptoms

177. Were your furnace and ducts professionally cleaned in the past year? ☐ Y ☐ N ☐ I don't know

178. Does your child sleep with stuffed animals? ☐ Y ☐ N

179. Does he sleep with feathers or Down pillows or comforters? ☐ Y ☐ N

180. How often is the bedding washed per month _____

181. Any bedwetting? ☐ Y ☐ N

182. Is there carpeting in the child's room? ☐ Y ☐ N

183. Does the child have clutter in their room? ☐ Y ☐ N

184. Is your child exposed to perfumes, scented products, or harsh cleaners? ☐ Y ☐ N

185. If yes, check all that apply
☐ Perfumes
☐ Scented products
☐ Harsh cleaners

186. Does he experience seasonal symptoms? ☐ Y ☐ N

187. If yes, please specify _____

188. Do you see insect or mice pests in your home? ☐ Y ☐ N ☐ I don't know

189. If yes, check all that apply
☐ Insects
☐ Mice

190. Do you use insecticides or rodenticides? ☐ Y ☐ N

191. Is there anything that might make your child's symptoms worse? _____

Neurological Symptoms

192. Is your child the type that puts everything in his/her mouth? ☐ Y ☐ N

193. Is there any old chipped flaking paint, especially around window sills, railings, doors, or anywhere in the child's environment? ☐ Y ☐ N ☐ I don't know

194. Could there be lead water pipes in your home, school or daycare? ☐ Y ☐ N ☐ I don't know

195. In pregnancy, did your home or workplace have lead water pipes? ☐ Y ☐ N ☐ I don't know

196. Do you regularly eat wild meat shot with lead bullets/ an ethnic diet with imported spices/ candy from Mexico? ☐ Y ☐ N

197. If yes, check all that apply
☐ Wild meat
☐ Ethnic diet with imported spices
☐ Candy from Mexico

198. During pregnancy? ☐ Y ☐ N

199. Do you use any ethnic, herbal remedies or products e.g. tongue powder, Kohl etc.? ☐ Y ☐ N

200. If yes, please specify _____

201. During pregnancy? ☐ Y ☐ N

202. (any details) _____

203. Do you cook, store or serve food in painted ceramic cookware or pewter? ☐ Y ☐ N

204. Does your child own inexpensive metal jewelry? ☐ Y ☐ N

205. Do you ever see them putting it in their mouth? ☐ Y ☐ N ☐ I don't know

206. Do you/ have you had any household items reported to contain lead e.g. candles, miniblinds, bags etc.? ☐ Y ☐ N

207. If yes, please specify _____

208. (any details) _____

209. Does the child have access to old fishing tackle? ☐ Y ☐ N ☐ I don't know

210. Does your child have access to battery operated toys, watches, flashlights, glass thermometers, compact fluorescent lights? ☐ Y ☐ N ☐ I don't know

211. If yes, please specify _____

212. (any details) _____

213. Does your child play with imported toys? ☐ Y ☐ N ☐ I don't know

214. If yes, which ones? _____

215. Do you ever see them putting it in their mouth ☐ Y ☐ N

216. Do you have old painted furniture? ☐ Y ☐ N

217. Has your child regularly left drool or teeth marks on the furniture ☐ Y ☐ N ☐ I don't know

218. Have you, your husband or any household members ever worked in battery manufacturing/recycling, radiator repairs, lead smelting, brass and bronze foundry, demolitions/renovations of old property, firing range or pottery glazing? ☐ Y ☐ N ☐ I don't know

219. If yes, please specify _____

220. (any details) _____

221. Any exposure to smoke from burning used wood or forest fires? ☐ Y ☐ N ☐ I don't know

222. ...if yes, when? _____

223. Any pica or mouthing behaviours? ☐ Y ☐ N

224. Any history of metal intoxication in child's mother prior to pregnancy ☐ Y ☐ N ☐ I don't know

225. (any details) _____

226. Have you or your child ever lived in an area where raised lead levels are more common? ☐ Y ☐ N ☐ I don't know

227. (any details) _____

Appendix B

Online Survey Instructions for the Experts

Content Validity

Clinicians utilize the Pediatric Environmental Health History (PEHH) questionnaire to identify environmental risk factors associated to various pediatric outcomes. It is administered to mothers/guardians of children as they seek etiological information for their child's condition. The intent of the PEHH questionnaire is solely to collect useful environmental information, as opposed to the patient's medical history. This environmental information is then used in conjunction with the patient's medical history to further assess the condition of interest. With a validated questionnaire, physicians will gain a better understanding of potential environmental factors that may be associated to children's health and consequently implement preventative recommendations for their patient's wellbeing.

The PEHH questionnaire consists of ten constructs/domains/sections and a total of 200 items/questions. The sections include demographics, general environment, and general environment for second household, school environment, daycare/day home environment, lifestyle, prenatal exposures, infancy/childhood, respiratory symptoms, and neurological symptoms. For your reference, the pdf. version of the PEHH questionnaire is attached below.

To facilitate our assessment of this questionnaire's content, the following survey requires your thorough and thoughtful review of each item pertaining to their relevant construct. You will be asked to select the following options for each item, in which you may suggest the appropriate change to be made based on your option.

a) Agree

b) Requires modification (A text field will open which states "suggest modification").

Modifications may include item re-wording or item deletion. For re-wording the item, please state: "Re-word", and then suggest the change to be made in the text box. For item deletion, please state: "Delete item".

At the end of each section, you will be asked to suggest any further changes to be made. For example, these changes may include item additions. If you would like to suggest an additional item, please state the item you would like to include, and where the item should be located.

You may save your work and return to it at a later time. If this is necessary, please select "Save and Return Later" at the very bottom of the survey. In this case, you will be provided with a validation code (which you will need to write down or remember), and enter to continue on with your saved work, using a different link which will be e-mailed to you upon selecting this option.

Please submit the survey once complete.

Note: Within the PEHH questionnaire, both constructs "general environment" and "general environment for second household" contain identical items. Therefore, the survey will exclude this construct, but will require your opinion for the remaining nine constructs.

[Attachment: "PEHH Questionnaire.pdf"]

Appendix C

"Item-level" and "Domain-level" Suggestions, Accepted/Rejected Questions/items, and Reason for Rejection

Rounds 1 and 2 "item- level" suggestions

Round 1 Item-level Suggestions (PEHH Version 1)					Round 2 Item-level Suggestions (PEHH Version 2)				
Item #	**Round 1 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason for Rejection (Exclusion criteria #)**	**Item #**	**Round 2 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason For Rejection (Exclusion criteria #)**
1	80	Formatting clarification (7) - Date Formatting clarification (9) - Date	Accepted Accepted		**1**	100			
2	90	Clarification (6) - What is the diff btw/ this and PHN#?	-	No modification made	**2**	100			
3	90	Clarification (6) - What is the diff btw/ this and Chart #?	-	No modification made	**3**	100			
4	100				**4**	100			
5	100				**5**	100			
6	90	Formatting clarification (7) - DD/MM/YYYY	Accepted		**6**	100			
7	80	Re-wording (4) - How did you find this clinic? Physician referral, internet etc.? Clarification (6) - Is the referral source or who called to make the apt? This may be different	Accepted Rejected	 Referral source – examples are provided	**7**	100			
8	70	Addition (4, 6, and 10) – Include father	Accepted (x3)		**8**	100			
9	100				**9**	100			
10	90	Clarification (10) - suggest being explicit about who this question refers to (Mom and Dad, not their adolescent child, for example	Rejected	Marital status of the parents/guardians	**10**	100			
11	100				**11**	87.5	Re-word (6) – marital status of parents	Accepted	
12	90	Addition (2) – Add dates for each country child has lived	Accepted		**12**	100			
13	90	Addition (10) - Suggest adding: Referring physician, healthcare provider, agency, etc?	Accepted		**13**	87.5	Re-word (10) recurrent – or countries	Accepted	

Round 1 Item-level Suggestions (PEHH Version 1)					Round 2 Item-level Suggestions (PEHH Version 2)				
Item #	**Round 1 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason for Rejection (Exclusion criteria #)**	**Item #**	**Round 2 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason For Rejection (Exclusion criteria #)**
14	50	Re-word (2) – Does your child have symptoms currently Re-word (4) – How long has your child had symptoms if any? Typo - (3, 6) – change 'experiences' to 'experienced' Re-word (10) - (i.e. For how long has your child experienced symptoms?)	Accepted Accepted Accepted Accepted		**14**	75	Re-word (7) – recurrent or countries Re-word (10) – recurrent – specify months/years	Accepted Accepted	
15	90	Re-word (4) – environmental 'exposures' instead of 'factors'	Accepted		**15**	100			
16	90	Clarification (6) - What is "conditions"? Is this "past medical history"?	-		**16**	100			
17	80	Addition of response options (6 and 10)	Rejected		**17**	100			
18	70	Re-word (6) Re-word (7 and 9)	Rejected		**18**	87.5	Formatting (7) – create a checkbox of symptoms for them to choose from	Rejected	Complicated formatting
19	80	Re-word (4 and 6) – Any members of household have similar symptoms	Accepted		**19**	100			
20	90	Re-word (4) – What's 'your relationship' with any persons with similar symptoms	Accepted		**20**	100			
21	100				**21**	100			
22	100				**22**	75	Re-word (6) – change this to focus on the child's relationship with others Re-word (10) – focus on child	Accepted Accepted	
23	90	Clarification (6) - Do you mean blood relatives OUTSIDE THE HOME?	Accepted		**23**	87.5	Re-word (10) – take out conditions	Accepted	
24	100				**24**	87.5	Addition of response options (3) – add work	Accepted	
25	100				**25**	100			

Round 1 Item-level Suggestions (PEHH Version 1)					Round 2 Item-level Suggestions (PEHH Version 2)				
Item #	**Round 1 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason for Rejection (Exclusion criteria #)**	**Item #**	**Round 2 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason For Rejection (Exclusion criteria #)**
26	50	Addition (2,6,7,9, and 10) – Add suburbs	Accepted		**26**	87.5	Re-word (10) – specify which details are of interest	Rejected	(1) Vague - No specific details we are looking for
27	100				**27**	100			
28	100				**28**	75	Re-word (2) – be more specific with which details are of interest Re-word (10) – obtain address for GIS mapping	Rejected Rejected	(1) Vague-Any details can be described (8) Patient confidentiality is a concern
29	70	Re-word (2) – approximate year home was built Clarification (4, and 10) – why 30 years?	Accepted Accepted		**29**	100			
30	70	Addition (2) Re-word (9) Addition of response options (10)	Accepted Accepted Rejected	(2) Will be explored through subsequent questions	**30**	100			
31	90	Clarification (4) - Not sure about rationale for 300 m for dry cleaners or gas station	Accepted - Changed all distance questions to 3 blocks		**31**	87.5	Re-word (3) – recurrent – remove ">30 years", as this will change with time if you're aiming for a particular date	Accepted	
32	100				**32**	62.5	Clarification (2) – confusing; prior home or current home? Re-word (7) Re-format (4) - Move to after question #38	Accepted Accepted Accepted	
33	100				**33**	75	Re-word (10) – Hard to interpret (e.g. what's continuous traffic)? Re-word (4) – Might include distance (3 blocks = x meters)	Rejected Accepted	(8) Data collected would tell us value of this question
34	100				**34**	87.5	Re-word (4) – heavy "truck" traffic	Rejected	(8) Evidence does not limit to only "truck" traffic

Round 1 Item-level Suggestions (PEHH Version 1)					Round 2 Item-level Suggestions (PEHH Version 2)				
Item #	**Round 1 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason for Rejection (Exclusion criteria #)**	**Item #**	**Round 2 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason For Rejection (Exclusion criteria #)**
35	80	Re-word (4 and 9) – 'coal fueled'	Accepted		**35**	75	Clarification (4) – rationale for distance Clarification (10) – Not sure about the distance	Accepted – Deleted item Accepted – Deleted item	
36	90	Re-word (9) - Are any pesticides used in your home or yard?	Accepted		**36**	100			
37	100				**37**	100			
38	90	Re-word (6) – last home was 'built' more than 30 years ago	Accepted		**38**	87.5	Re-word (10) – be more specific with the distance scale (e.g. 3 blocks = x meters)	Accepted	
39	100				**39**	100			
40	90	Re-word (10) - any renovation projects including demolition/removal/repair/replacement	Accepted		**40**	100			
41	90	Formatting – need more space for response (10)	Rejected	-	**41**	75	Addition (7) – which pesticides and how often? Addition (1) – Ask more about pesticides	Accepted Accepted	
42	90	Addition (4) – Have the smells from these bothered you and in what way?	Rejected	(3) Won't enhance clinical understanding	**42**	100			
43	100				**43**	87.5	Clarification (3) – when? During the child's lifetime?	Accepted	
44	100				**44**	87.5	Addition (3) – time of renovation?	Rejected	(4) No time frame of interest; we modified it to "current" home to be more specific
45	90	Addition of response option (4) – Pellet stove, kerosene heaters	Accepted		**45**	100			
46	90	Addition of response option (4) – as above	Accepted		**46**	87.5	Re-word (4) – "Check all that apply:"	Accepted	

Round 1 Item-level Suggestions (PEHH Version 1)					Round 2 Item-level Suggestions (PEHH Version 2)				
Item #	**Round 1 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason for Rejection (Exclusion criteria #)**	**Item #**	**Round 2 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason For Rejection (Exclusion criteria #)**
47	80	Addition (7 and 10) - Is the stove/range ever used to heat the home?	Rejected	(3) Won't enhance clinical understanding	**47**	100			
48	100				**48**	100			
49	100				**49**	87.5	Re-word (3) – Where do you see these?	Accepted	
50	80	Re-word (4) – Who smokes in household Clarification (6) – Why only household?	Accepted Accepted		**50**	100			
51	60	Addition of response options (4, 8, and 10) - Car Reword or Addition (5) - Do smokers wash hands or clothes before interacting with the child	Accepted Accepted		**51**	100			
52	80	Addition (2 and 7) – Types of pets	Accepted		**52**	87.5	Addition (4) – Are these properly vented?	Accepted	
53	0.80	Clarification (4) – why 30 years? Re-word (2) – Approximate year built	Accepted Accepted		**53**	100			
54	80	Addition (2, 4, and 6) – Idling school buses/vehicles Re-word (9) - distance	Rejected Accepted	(2) Explored in subsequent questions	**54**	100			
55	60	Clarification (4) – distance?	Accepted		**55**	100			
56	90				**56**	87.5	Re-word (10) – "have you ever had your home checked for radon"	Accepted	
57	100				**57**	87.5	Re-word (10) – specify which details are of interest	Rejected	(8) Any particular details patient provides are of interest
58	100				**58**	100			
59	100	Re-word (9) – what type of industry and emissions? And 'coal fueled' Addition (4) – Do you smell these? Do they bother you?	Accepted Rejected	(3) Won't enhance clinical understanding	**59**	100			

Round 1 Item-level Suggestions (PEHH Version 1)					Round 2 Item-level Suggestions (PEHH Version 2)				
Item #	**Round 1 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason for Rejection (Exclusion criteria #)**	**Item #**	**Round 2 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason For Rejection (Exclusion criteria #)**
60	80	Addition (7) - pesticides used when children are playing on the fields or during the school day Addition of response options (4) – inside, outside, or in yard of care building	Rejected Accepted	(2) Current question implies exposure if children are playing on the fields that have been sprayed	**60**	87.5	Re-word (2) – change focus of question on the child	Rejected	(8) Exploring P/G smoking habits in general
61	80				**61**	87.5	Statement (4) – Not sure you'll get an accurate response to this	--	(8) Intent is to assess the relevancy of the questions and not response accuracy
62	100				**62**	100			
63	100				**63**	75	Addition (3) – recurrent – What kind of pets? Addition (6) – recurrent - What kind of pets?	Accepted Accepted	
64	100				**64**	100			
65	100	Addition (4) – Do you notice any smells from these?	Accepted		**65**	75	Re-word (4) – "school building" Clarification (10) – can people answer this accurately?	Accepted Accepted	(8) Intent at this point is to assess relevancy of the question and not accuracy of responses
66	90	Addition of response options (6 and 9) - Suburban Addition (4 and 8) – details of school location	Accepted Rejected	(2) Details asked in subsequent question	**66**	100			
67	70	Addition (8) – secondary question about social environment, safety of play equipment etc.	Rejected	(3) Won't enhance clinical understanding	**67**	75	Re-word (2)- "What's most usual mode of transportation your child uses to get to school?" Addition (3) – Is it along a busy road if child walks	Accepted Rejected	(3) Proximity to major road and heavy traffic explored in subsequent questions

Round 1 Item-level Suggestions (PEHH Version 1)					Round 2 Item-level Suggestions (PEHH Version 2)				
Item #	**Round 1 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason for Rejection (Exclusion criteria #)**	**Item #**	**Round 2 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason For Rejection (Exclusion criteria #)**
68	90	Addition (2 and 7) – types of pets in child's classroom	Accepted		**68**	87.5	Re-word (10) – Hard to interpret what 'continuous' traffic is. Re-word for consistency with prior domain	Accepted	
69	100				**69**	100			
70	80	Addition (2) – Hours per week Addition (4) – How many kids attend	Accepted Accepted		**70**	100			
71	80	Re-word (2) – Approximate year built Re-word (10) – year of construction	Accepted Accepted		**71**	87.5	Clarification (4) – recurrent - Not sure about the distance	Accepted	
72	60	Addition of response options (2, 6, 9, and 10) - Suburban	Accepted		**72**	100			
73	100				**73**	100			
74	80	Addition (2) – Ask first about major road or highway, then this question Re-word (9) – what constitutes 'heavy traffic'	Accepted Accepted		**74**	100			
75	100				**75**	87.5	Re-word (10) – that are "within" 5 km if the school…	Accepted	
76	100				**76**	100			
77	100				**77**	100			
78	100				**78**	75	Re-word (7) – US equivalent of a portable? Re-word (10) – US equivalent of a portable?	Rejected Rejected	(6) This is because the term 'portable' is preferred in our local area
79	90	Re-word (9) – specify what type of industry and emissions; should be 'coal fueled'	Accepted		**79**	100			
80	90	Addition of response options (2) – "I don't know"	Accepted		**80**	100			
81	100				**81**	100			
82	100				**82**	100			
83	100				**83**	100			
84	100				**84**	100			
85	100				**85**	100			
86	70	Statement (4) – Item is redundant Re-word (5 and 8) – "Mother" instead of "mom"	Accepted		**86**	100			

Round 1 Item-level Suggestions (PEHH Version 1)					Round 2 Item-level Suggestions (PEHH Version 2)				
Item #	**Round 1 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason for Rejection (Exclusion criteria #)**	**Item #**	**Round 2 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason For Rejection (Exclusion criteria #)**
87	30	Re-word (3, 5, and 8) – take out 'parental' Clarification (4, 6, 7, and 9) – what do you mean by 'parental age'?	Accepted Accepted		**87**	100			
88	80	Re-word (5 and 8) – "Father" instead of "dad"	Accepted		**88**	100			
89	30	Re-word (3, 5, and 8) – Take out 'parental' Clarification (4, 6, 7, and 9) – what do you mean by 'parental age'?	Accepted Accepted		**89**	87.5	Re-word (2) – Are symptoms better, worse, or same at school?	Accepted	
90	70	Clarification (4) - Confusing Addition (6) – Include work setting for both parents Clarification (9) – What is the "work setting" referring to? Mother's job? Father's job?	Accepted Accepted		**90**	100			
91	90	Clarification (4) – Why past 'year'?	Accepted		**91**	100			
92	80	Clarification (4) – as above Addition of detail (8)	Rejected Rejected	(2) This question explores any detail provided by the P/G	**92**	87.5	Clarification (4) – Licensing and regulations	Rejected	(3) Won't enhance clinical understanding
93	70	Clarification (8) – Who is the "you" in this question? Requires more clarity Re-word (3 and 6) – Add father's education also as this assumes mother is filling out	Accepted Accepted		**93**	100			
94	70	No comment (3) Re-word (6) – As above Re-word (9) – Consider father	Accepted Accepted		**94**	100			
95	80	Re-word (6) – as above Re-word (9) – as above	Accepted Accepted		**95**	100			
96	90	Clarification (8) – "single" parent family?	Accepted		**96**	100			
97	90	Clarification (6) – What is this question about?	Rejected	Question is about stress/grief affecting lifestyle	**97**	100			
98	90	Clarification (6) – as above	Rejected		**98**	87.5	Re-word (10) – what's fairly continuous traffic – be consistent with prior domains	Accepted	
99	90	Clarification (6) – as above	Rejected		**99**	100			
100	100				**100**	100			
101	100				**101**	100			

Round 1 Item-level Suggestions (PEHH Version 1)					Round 2 Item-level Suggestions (PEHH Version 2)				
Item #	**Round 1 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason for Rejection (Exclusion criteria #)**	**Item #**	**Round 2 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason For Rejection (Exclusion criteria #)**
102	80	Clarification (4) – why once per month? Re-word (6) - how often are hot tubs/swimming pools used? As opposed to once per month	Rejected Rejected	-Evidence?	**102**	100			
103	100				**103**	100			
104	80	Addition (6) – Do hours change on weekends? Addition (8) – ask about content child watches	Rejected Rejected	(3) Will not enhance clinical understanding	**104**	100			
105	80	Addition (6) - Do hours change on weekends? Addition (9) - May consider adding video game playing as well.	Rejected Accepted	(3) Will not enhance clinical understanding	**105**	100			
106	80	Re-word (5) - Should be combined with #132 and broadened to be all 'screens' per american acad of ped guidelines Addition (10) - Consider asking if cell phone is primarily used for talking or texting	Rejected Accepted	(1) Unclear	**106**	100			
107	100				**107**	100			
108	90	Re-word (4) – 'any problems with pregnancy'	Accepted		**108**	100			
109	100				**109**	100			
110	60	Re-word (2) – approximate age of home Clarification (6) – during pregnancy? Clarification (9) – during pregnancy?	Accepted Accepted Accepted		**110**	100			
111	80	Addition (2) – first ask about major road and then this question	Accepted Accepted		**111**	87.5	Re-word (10) – doesn't make sense	Rejected	-
112	100				**112**	100			
113	100				**113**	100			
114	100				**114**	100			
115	100				**115**	87.5	Addition (6) – What kind of pets	Accepted	

Round 1 Item-level Suggestions (PEHH Version 1)					Round 2 Item-level Suggestions (PEHH Version 2)				
Item #	**Round 1 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason for Rejection (Exclusion criteria #)**	**Item #**	**Round 2 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason For Rejection (Exclusion criteria #)**
116	90	Re-word (9) - type of "industry" and "emissions" and change to 'coal fueled'	Accepted		**116**	100			
117	100				**117**	87.5	Addition (4) – What do you do there?	Rejected	(2) Details are explored in subsequent questions
118	80	Re-word (4) – specify 'during pregnancy' Re-word (10) – specify 'during pregnancy'	Accepted Accepted		**118**	100			
119	90	Addition (3) - Relevant to all Q re occupation; suggest asking: Do you work with any toxic materials/exposures; Are you required to wear protective clothing?	Rejected	(3) Implied by the occupation; querying protective clothing will not enhance clinical understanding	**119**	100			
120	80	Re-word (3) – Same as 146 Clarification (10) - specify 'during pregnancy'	Accepted Accepted		**120**	100			
121	100				**121**	87.5	Recurrent - Be more detailed about the time frame of interest (10)	Accepted	
122	100				**122**	87.5	Re-word (3) – What other jobs did either of them hold in the past	Accepted	
123	100				**123**	100			
124	100				**124**	100			
125	70	Re-word (3) – Assumes mom is filling in Re-word (4) – specify 'during pregnancy' Re-word (6) – Assumes mom filling; specify if 'mom' smoked 'during pregnancy	Accepted Accepted Accepted		**125**	87.5	Re-word (7) – recurrent - "single" parent family household	Accepted	
126	80	Re-word (4) - If husband smokes, how many years did he smoke before the pregnancy? Did he smoke during the pregnancy? Addition (6) – specify husband smoking 'during pregnancy'	Accepted Accepted		**126**	87.5	Addition (4) – More stress questions out there – consider something more substantial than this	Rejected	(2) Subsequent questions will explore in more depth

Round 1 Item-level Suggestions (PEHH Version 1)					Round 2 Item-level Suggestions (PEHH Version 2)				
Item #	**Round 1 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason for Rejection (Exclusion criteria #)**	**Item #**	**Round 2 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason For Rejection (Exclusion criteria #)**
127	90	Addition of response option (4) – inside or outside	Accepted		**127**	100			
128	90	Re-word (6) – specify if 'mother' had illnesses during pregnancy	Accepted		**128**	87.5	Re-word (10) – "please describe the cause of stress/grief for your family"	Accepted	
129	100				**129**	100			
130	80	Re-word (6) – prescription medications for 'therapeutic use' Addition (7) – include prenatal vitamins	Accepted Accepted		**130**	100			
131	100				**131**	100			
132	70	Addition of response option (2) – homeopathic, naturopathic, imported ethnic remedies Addition of response option (4) – natural or other medications from other countries Re-word (6) – Don't need to specify that herbs were "Chinese". There are all sorts of herbal products that can be harmful.	Accepted Accepted Accepted		**132**	87.5	Clarification (4) – Why 1 month?	Accepted – remove "1 month" due to insufficient evidence	
133	90	Re-word (6) – recreational drug use of prescription or elicit drugs	Accepted		**133**	100			
134	100				**134**	100			
135	100				**135**	100			
136	100				**136**	62.5	Addition of options (10) – blue tooth or hands free? -Formatting – checkboxes for options -Addition of options (4) – Headset or speaker phone	Accepted Accepted Accepted	

Round 1 Item-level Suggestions (PEHH Version 1)					Round 2 Item-level Suggestions (PEHH Version 2)				
Item #	**Round 1 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason for Rejection (Exclusion criteria #)**	**Item #**	**Round 2 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason For Rejection (Exclusion criteria #)**
137	60	Clarification (4) – asking them what they think risk is? Clarification (6) – not sure where you're getting at with this question Clarification (10) - Can you clarify this question? Are you asking the caregiver to identify potential risks to thefetus from sports/hobby involvement? Re-word (9) - specify what you mean by "risks from hobbies or sports"	Accepted Accepted Accepted Accepted		**137**	87.5	Re-word (3) - use more simple language	Accepted	
138	60	Clarification (2) – want to sort out 'good' vs 'bad fish re neurodevelopment? Addition (4) – Getting commercially or doing fishing themselves? Addition (7) – kind of seafood and quantities Formatting (10) – move near exploration of more sensitive topics	Rejected Rejected Accepted Accepted	(1) Vague -Modified to an 'any details' question	**138**	100			
139	80	Re-word (6) - Should start by asking if baby was fed by breast, bottle or both. If breast, how long? Addition (10) - Consider asking what medications/supplements Mom was taking while lactating	Accepted Accepted		**139**	100			
140	90	Delete (6) - If you ask above Q, then not sure if you need this one.	Rejected	Didn't delete entire question, because exploring 'soothers' are still important.	**140**	87.5	Re-word (10) – recurrent – Consider occupation in months 'prior to and during' pregnancy	Accepted	
141	90	Delete (6) – As above	Rejected	Explore soother only	**141**	100			

Round 1 Item-level Suggestions (PEHH Version 1)					Round 2 Item-level Suggestions (PEHH Version 2)				
Item #	**Round 1 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason for Rejection (Exclusion criteria #)**	**Item #**	**Round 2 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason For Rejection (Exclusion criteria #)**
142	100				**142**	87.5	Re-word (10) – recurrent - Occupation in months 'prior to and during' pregnancy	Accepted	
143	100				**143**	100			
144	100				**144**	100			
145	100				**145**	87.5	Re-word (10) – What's fairly continuous? – be consistent with prior domains	Accepted	
146	70	Clarification (2) – want to get details of food vs. bad fish re neurodevelopment Addition (7) – type and quantity of seafood Addition of detail (10) – As in prior section	Rejected Rejected Accepted	(1) Vague (3) Won't enhance clinical understanding	**146**	100			
147	80	Addition (1) – as if fruits/veggies are peeled Addition (6) – How many servings	Accepted Accepted		**147**	100			
148	100				**148**	100			
149	100				**149**	100			
150	90	Clarification (4) – What are you hoping to learn or do with this info?	Rejected	Enhance clinical understanding of duct maintenance and relevance to respiratory symptomatology	**150**	100			
151	100				**151**	100			
152	100				**152**	100			
153	100				**153**	100			
154	80	Clarification (3) – Not sure of relevance of bedwetting to resp. symptoms Clarification (6) – Why is this respiratory?	Accepted Accepted		**154**	100			
155	100				**155**	100			
156	100				**156**	100			
157	100				**157**	100			
158	90	Re-word (10) - Consider giving examples of 'scented products' and 'harsh cleaners'	Rejected	(2) Explored in subsequent 'any details' question	**158**	100			

Round 1 Item-level Suggestions (PEHH Version 1)					Round 2 Item-level Suggestions (PEHH Version 2)				
Item #	**Round 1 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason for Rejection (Exclusion criteria #)**	**Item #**	**Round 2 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason For Rejection (Exclusion criteria #)**
159	80	Re-word (4) – specify seasonal symptoms of interest Typo (10) – change he to s/he	Accepted Accepted		**159**	100			
160	100				**160**	100			
161	90	Re-word (10) - Consider modifying to include asking about 'evidence of rodents such as droppings'	Accepted		**161**	100			
162	90	Addition (4) - cockroaches	Rejected	(2) Already explored as per "insects"	**162**	100			
163	90	Addition (10) - 'or ever hired a professional exterminator'. Follow-up questions may include techniques used to deal with pests such as pesticide bombs, etc.	Rejected	(2) Current question still implies overall how pest is dealt with	**163**	100			
164	90	Re-word (4) – anything you "feel" makes your child's symptoms worse	Accepted		**164**	87.5	Formatting (3) - Leave more space for responses	Rejected	Formatting
165	90	Re-word (8) – 'does your child tend to put objects in his mouth'	Accepted		**165**	75	Addition (10) – Duration of breastfeeding Re-word (7) – Assumes as if mother is breastfeeding.	Rejected Accepted	(2) Explored in Infancy Diet
166	90	Re-word (4) - Instead of especially, say "For example"	Accepted		**166**	100			
167	90	Re-word (4) - Ask: "Are there lead pipes" Of course there "could be" but you want to know for sure	Accepted		**167**	100			
168	90	Delete (4) - Q is not valuable unless its specifically about prenatal/neonatal	Rejected	Question specifies 'in pregnancy'	**168**	87.5	Re-word (7) – Assumes as if mother is breastfeeding	Accepted	
169	80	Separate three parts of this question (8) Re-word (10) - Make distinction between imported spices and Mexican candy, as the imported spices of primary concern originate in Asia	Rejected Accepted	Separated in subsequent checkbox question	**169**	87.5	Re-word (10) – Specify 'immediately prior to or during pregnancy'	Accepted	
170	100				**170**	100			

Round 1 Item-level Suggestions (PEHH Version 1)					Round 2 Item-level Suggestions (PEHH Version 2)				
Item #	**Round 1 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason for Rejection (Exclusion criteria #)**	**Item #**	**Round 2 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason For Rejection (Exclusion criteria #)**
171	100				**171**	100			
172	90	Re-word (10) – 'to improve health or for ceremonial uses'	Accepted		**172**	100			
173	100				**173**	100			
174	100				**174**	100			
175	100				**175**	87.5	Re-word (10) – specify 'during pregnancy'	Accepted	
176	100				**176**	87.5	Re-word (3) – detail - How much?	Accepted	
177	100				**177**	87.5	Addition (4) – Formula	Accepted	
178	100				**178**	100			
179	80	Clarification (4) - Are pple likely to know this? The ones that do know likely got rid of them Re-word (10) - ask specifically about miniblinds produced in Asia and imported from 19** to 19**	Rejected Accepted	Intent is not to explore accuracy, but relevancy	**179**	100			
180	100				**180**	75	Re-word (7) – solid foods Clarification (4) – manufactured or solids?	Accepted Accepted	
181	100				**181**	87.5	Re-word (2) – ask about food allergies	Rejected	(2) Explore restricted diets instead
182	100				**182**	87.5	Re-word (2) – ask unusual feeding patterns compared to peers	Rejected	(3) Won't enhance clinical understanding
183	90	Clarification (10) - This question is likely to provide a universal'yes' answer. What do you have in mind here? Hg exposure? Can you phrase in a more specific way?	Accepted		**183**	75	Re-word (3) – be more specific if gearing towards pica Re-word (10) – give more examples	Accepted Accepted	
184	100				**184**	100			
185	100				**185**	100			

Round 1 Item-level Suggestions (PEHH Version 1)					Round 2 Item-level Suggestions (PEHH Version 2)				
Item #	**Round 1 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason for Rejection (Exclusion criteria #)**	**Item #**	**Round 2 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason For Rejection (Exclusion criteria #)**
186	100				**186**	75	Re-word (3) – recurrent - What seafood and how often Re-word (7) – recurrent - Type of fish, frequency, and portion	Accepted Accepted	
187	90	Addition (10) - where were they made?	Rejected	(3) Won't enhance clinical understanding	**187**	100			
188	90	Re-word (10) - Change to: ...putting 'the toys' in their mouth?	Accepted		**188**	100			
189	100				**189**	100			
190	90	Re-word (4) – Leave 'drool'	Accepted		**190**	100			
191	90	Re-word (10) - Change so it's not assumed Mom is completing survey	Accepted		**191**	87.5	Re-word (7) - % overall diet that is organic	Accepted	
192	100				**192**	87.5	Re-word (3) – such as…	Rejected	Any source is acceptable
193	80	Addition (8) - what kinds of details would you expect to hear? maybe a probing question or 2 might help Delete (10) – redundant as item 219	Rejected Accepted	-Any details are of interest	**193**	87.5	Re-word (3) – such as…	Rejected	Any details are of interest
194	80	Re-word (4) – 'any wood' Re-word (10) - Consider asking specifically about copper chromium arsenate-treated wood	Accepted Accepted		**194**	87.5	Clarification (9) – limited evidence supporting 'regular' duct cleaning	Accepted - EPA suggests to explore 'maintenance'	
195	100				**195**	100			
196	70	Statement (4) – seems repetitive Re-word (9) - Consider defining 'pica' Re-word (10) - Consider defining 'pica'	 Accepted Accepted		**196**	100			
197	90	Re-word (8) – re-word question depending on who the respondent is	Accepted		**197**	87.5	Addition (3) – What kind of vacuum cleaner?	Accepted	
198	100				**198**	100			
199	100				**199**	100			

Round 1 Item-level Suggestions (PEHH Version 1)					Round 2 Item-level Suggestions (PEHH Version 2)				
Item #	**Round 1 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason for Rejection (Exclusion criteria #)**	**Item #**	**Round 2 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason For Rejection (Exclusion criteria #)**
200	100				**200**	100			
					201	100			
					202	100			
					203	100			
					204	100			
					205	100			
					206	100			
					207	87.5	Re-word (3) – or cockroaches	Rejected	(2) Cockroaches are explored as 'insects'
					208	100			
					209	100			
					210	62.5	Re-word (10) – recurrent - Consider giving examples of wood Re-word (3) – recurrent - more detail (e.g. woodstove, fireplace, agricultural burning, candles. Etc.) Addition of response options (4) – recurrent - fireplace and woodstove	Rejected Rejected Rejected	(2) Presented explicitly in subsequent question (2) Explored in General environment (2) Explored in General Environment
					211	87.5	Clarification (4) – What type of wood? – Ask more directly if you are more interested in treated wood	Rejected	Smoke exposure from any wood
					212	100			
					213	100			
					214	75	Addition (4) – Do you know what the AQHI is? Addition (10) – Do you limit your child's activities?	Accepted Accepted	
					215	87.5	Re-word (10) – ask about which respiratory symptoms you're specifying	Accepted	

Round 1 Item-level Suggestions (PEHH Version 1)					Round 2 Item-level Suggestions (PEHH Version 2)				
Item #	**Round 1 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason for Rejection (Exclusion criteria #)**	**Item #**	**Round 2 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason For Rejection (Exclusion criteria #)**
					216	87.5	Re-word (3) – 'everything and anything'	Accepted	
					217	75	Addition (10) – What are they putting in their mouth? Addition of response options (4) – occasionally, frequently, or all of the time	Accepted Accepted	
					218	87.5	Re-word (3) – more detail (e.g. around porches, outdoor walls)	Accepted	
					219	87.5	Delete (4) – people are not likely to know this	Rejected	Intent is not to explore accuracy, but relevancy
					220	100			
					221	100			
					222	100			
					223	100			
					224	100			
					225	100			
					226	100			
					227	100			
					228	100			
					229	100			
					230	100			
					231	87.5	Delete (4) – unlikely to get valuable answer to this	Rejected	Intent is not to explore accuracy, but relevancy
					232	100			
					233	87.5	Re-word (10) – remove the word 'old' because even modern fishing tackle uses lead	Accepted	
					234	100			
					235	100			
					236	100			
					237	100			
					238	100			
					239	100			
					240	100			

Round 1 Item-level Suggestions (PEHH Version 1)					Round 2 Item-level Suggestions (PEHH Version 2)				
Item #	**Round 1 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason for Rejection (Exclusion criteria #)**	**Item #**	**Round 2 Item PA**	**Expert Suggested Modifications (Expert #)**	**Accepted/ Rejected?**	**Reason For Rejection (Exclusion criteria #)**
					241	100			
					242	100			
					243	100			
					244	87.5	Addition (7) – History of siblings with metal intoxication?	Rejected	(7) Medical history
					245	100			
					246	100			
					247	100			
					248	100			

Legend:

	Unique item-level suggestions by expert #4
	Unique item-level suggestions by expert #5
	Items posing recurrent expert suggestions

Rounds 1 and 2 "domain-level" suggestions

Round 1 "Domain-Level" suggestions (PEHH Version 1)			
Domain	**Modification category**	**Accepted/Rejected?**	**Reason for Rejection**
Demographics	Addition (x1): With whom does child live?	Rejected	- (4) Would like to know where child spends most of their time
	Addition (x1): activities spent outside	Accepted	
	Re-word (x1): Assumes mom filling out	Accepted	
	Re-word (x1) items are not "demographics" (so we re-named the construct)	Accepted	
	Statement (x2) Add drop-down menus to summarize data.	Rejected	- Complicated formatting
	Assumption that child has symptoms, where this may not be the case.	Accepted	
Demographics Summary Additions and Re-wording 6 suggested modifications -Accepted only 4 -Rejected 2			
General Environment	Addition (x1): Something specific about flooring of house	Accepted	
	Addition (x4): Smoke detectors CO detectors Radon check Symptoms	Accepted Accepted Accepted Rejected	-(2) This will be

Round 2 "Domain-Level Suggestions (PEHH Version 2)			
Domain	**Modification category**	**Accepted/Rejected?**	**Reason for Rejection**
General Information			
General Information Summary No 'domain-level' suggestions provided			
General Environment	Statement (x1): Many of your question pairs (e.g. 47-48, 49-50, 52-53) could be paired down to 1 question	Accepted	-Questionnaire will undergo refinement in subsequent steps.
	Addition (x1): Do you have cockroaches	Rejected	- (2) Insects explored in Respiratory Section

Round 1 "Domain-Level" suggestions (PEHH Version 1)				Round 2 "Domain-Level Suggestions (PEHH Version 2)			
Domain	**Modification category**	**Accepted/Rejected?**	**Reason for Rejection**	**Domain**	**Modification category**	**Accepted/Rejected?**	**Reason for Rejection**
	better/worse/same in home env. Addition (x3): Hobbies 3rd hand smoke Mode of transportation Addition (x5): Condition of home Water source Smoke detector Radon Exposure to farm animals Addition (x5): Smoke detector CO detector Radon Where child spends time Ventilation of home Addition (x1) Air quality (i.e. cleaning supplies, air fresheners etc.) Addition (x1): Formaldehyde and whether cleaners	 Rejected -Rejected -Rejected Accepted Rejected Accepted Accepted Accepted Accepted Accepted Accepted Rejected Accepted	covered in school environment and home environment will be used as standard comparison - (2) Hobbies explored in Lifestyle -(2) General smoking habits explored through smoking questions - (3) Mode of transportation unlikely to enhance clinical understanding - (2) Potential sources of toxicants explored in neurodevelopmental section (e.g. lead pipes) -(3) Ask about general maintenance		Addition (x2): Does the child smoke? Does the child work?; if yes, what type of work, hours, injury, etc. Addition (x1): Question regarding source of family's drinking water Addition (x1): Ask more about pesticides	 Accepted Rejected Rejected Accepted	 - (2) Work explored in question: Where does child spend most of their time? - (2) Water pipes explored to provide hint of contamination

Round 1 "Domain-Level" suggestions (PEHH Version 1)				Round 2 "Domain-Level Suggestions (PEHH Version 2)			
Domain	**Modification category**	**Accepted/Rejected?**	**Reason for Rejection**	**Domain**	**Modification category**	**Accepted/Rejected?**	**Reason for Rejection**
	are safely stored	Accepted					
Summary General Environment: Additions 20 suggested modifications -Accepted 14 unique suggestions -Rejected 6				**Summary General Environment:** Additions 6 suggested modifications -Accepted 3 -Rejected 3			
School Environment	Addition (x1): Symptoms worse at school?	Accepted		**School Environment**	Addition (x1): Are there others that have complained about school smells (e.g. teachers, parents, and/or students?	Accepted	
	Addition (x1): How is building heated	Accepted			Addition (x1): Do school buses line up and drop kids off near school entrance?	Rejected	- (2) Idling of school buses explored in items 60 and 70
	Addition (x1): Do smells of vehicles and gassing bother you?	Accepted			Addition (x1): Are there art classes? If yes, which media are used?	Rejected	-(2) Smells that bother child can provide detailed information
	Addition (x2): What was school previously used for	Rejected	-Provide limited information				
	How is school ventilated?	Rejected	-(2) Exploring smells that bother child would provide hint of ventilation				
	Addition (x8): Mold						
	Water damage						
	Recycling	Accepted					
	Green cleaning products	Accepted Rejected					
	School siting issues	Rejected					
	Natural light	Rejected					
	Access to green space outdoors	Rejected Rejected					
	Adequate hand washing facilities	Rejected					
	Addition (x1): Air quality (i.e. cleaning supplies, air fresheners etc.)	Rejected					

Round 1 "Domain-Level" suggestions (PEHH Version 1)				Round 2 "Domain-Level Suggestions (PEHH Version 2)			
Domain	**Modification category**	**Accepted/Rejected?**	**Reason for Rejection**	**Domain**	**Modification category**	**Accepted/Rejected?**	**Reason for Rejection**
	Addition (x1): School have previous use?	Rejected					
Summary School Environment: -Additions -15 suggested modifications -Accepted 5 -Rejected 10				**Summary School Environment:** -Additions -3 suggested modifications -Accepted 1 -Rejected 2			
Daycare/Day Home Environment	Addition of response options (x1): IDK for many of these questions	Accepted		**Daycare/Day Home Environment**	Addition (x1): Ask more about pesticides	Accepted	
	Add (x2): How is building heated?	Accepted					
	Toxic materials used in art room?	Rejected	-(2) Smells that bother child can provide hint of this				
	Addition (x1): Cleaning products used?	Rejected					
	-Combine both daycare and school Qs	Rejected	-Both are different environments and require comprehensive assessment				
	Addition (x1): Do symptoms worsen?	Rejected					
	Addition (x1): Air quality (i.e. cleaning supplies, air fresheners etc.)	Rejected	- (2) Smells that bother child can provide hint of this				
	Addition (x1):		- (3) Will not help				

Round 1 "Domain-Level" suggestions (PEHH Version 1)				Round 2 "Domain-Level Suggestions (PEHH Version 2)			
Domain	**Modification category**	**Accepted/Rejected?**	**Reason for Rejection**	**Domain**	**Modification category**	**Accepted/Rejected?**	**Reason for Rejection**
	Regulation checks	Rejected	enhance clinical understanding				
Daycare/Home Summary: Additions -8 suggested modifications -Accepted 1 -Rejected 7				**Daycare/Home Summary:** Additions -1 suggested modification -Accepted 1			
Lifestyle	Addition (x1): Ask where parents left work clothes if industrial work Addition (x2): Time spent outside Other activities done daily Addition (x1): Child's social life w/ friends Addition (x1): Q's about specific hobbies known to have environmental risks	Rejected Accepted Accepted Rejected Rejected	- (2) Information about work can be provided in 'any details' -Would require social environment domain - (2) Explore risk from hobbies/sports	**Lifestyle**	Statement (x1): In US, it's not uncommon for the primary caregiver to be someone other than a mother/father. This section needs work to include that person	Accepted	
Summary Lifestyle Additions -5 suggested modifications -Accepted 2 -Rejected 3				**Summary Lifestyle** Statement -1 suggestion -Accepted to incorporate this suggestion			
Prenatal Exposures	Re-word (x1): Assumes to be mom; could be dad filling it out Clarification required (x1) Addition (x1): Possible agents	Accepted Rejected	- (7) Addressed in	**Prenatal Exposures**	Clarification (x1) What if they say child is adopted? You may need a place for this	Accepted	

Round 1 "Domain-Level" suggestions (PEHH Version 1)				Round 2 "Domain-Level Suggestions (PEHH Version 2)			
Domain	**Modification category**	**Accepted/Rejected?**	**Reason for Rejection**	**Domain**	**Modification category**	**Accepted/Rejected?**	**Reason for Rejection**
	affecting fetus		medical history				
	Addition (x1): In utero lead exposure	Rejected	- (2) Potential Pb exposure in Neurodevelopmental section				
	Addition (x1): Maternal/paternal anxiety	Rejected	- (2) General stress explored in Lifestyle				
Summary prenatal Re-word and Additions -5 suggested modifications -Accepted 1 (re-wording) -Rejected 4				**Summary prenatal** Clarification -1 suggestion -Accepted to incorporate this suggestion			
Infancy/Childhood	Addition (x1): When child start eating manufactured foods	Accepted		**Infancy Diet**	Addition (x1): Water source – well, community water system?	Rejected	- (2) Water pipes explored in depth in neurodevelopmental section to determine potential sources of Pb exposures
	Re-word (x1): Domain should be labeled diet/food	Accepted					
	Addition (x1): Juice and soft drink intake	Rejected	- (2) Can be explored through allergies/restrictions				
	Addition (x1): Sleep and bowel habits	Rejected	- (7) Limit focus to diet – bowel habits can be explored in medical history				
	Addition (x1): Pica and ingestion of non-food items	Accepted					
	Addition (x1): Organic food consumption						

Round 1 "Domain-Level" suggestions (PEHH Version 1)				Round 2 "Domain-Level Suggestions (PEHH Version 2)			
Domain	**Modification category**	**Accepted/Rejected?**	**Reason for Rejection**	**Domain**	**Modification category**	**Accepted/Rejected?**	**Reason for Rejection**
		Accepted					
Summary Infancy/Childhood Re-word and Additions -6 suggested modifications -Accepted 4 -Rejected 2				**Summary Infancy Diet:** Addition -1 suggested addition -Rejected			
Respiratory Symptoms	Addition (x1): Questions that can assess family Hx of asthma	Rejected	- (2) Explored in Demographics section	**Additional Environmental Factors Affecting Respiratory Symptoms**	Addition (x1): Might add a question regarding asthma (e.g. Have you been told your child has asthma?)	Rejected	- (7) Information provided in medical history
	Addition (x4): Qs about flood/mold	Rejected	- (2) Covered in General Environment -Varies		Addition (x1): Do you have air conditioning?	Accepted	
	Level of air pollution	Rejected	- (7) Covered in medical history		Addition (x1): Do you run any air cleaning devices?	Accepted	
	Monitor AQHI	Accepted			Addition (x1) Any exposure to asbestos?	Accepted	
	Child have asthma or wheeze?	Rejected			Have you tested for radon?	Accepted	
	Addition (x1): Associate problem with exposures	Accepted			Addition (x1) Cooking fuel gas vs. electric? If gas, vented?	Accepted	
	Re-word (x1): Rename construct				Addition (x1) Pets allowed in child's bedroom?	Rejected	- (2) Pets explored in General Environment
	Addition (x1): Pets	Accepted	- (2) Explored in General Environment				
	Addition (x1): Mopping or HEPA vacuuming	Rejected					
		Accepted					
Summary Respiratory Section Re-word and additions -9 suggested modifications -Accepted 4 -Rejected 5				**Summary Respiratory Section** Additions -7 suggested modifications -Accepted 5 -Rejected 2			
Neurodevelopmental	Addition (x1):			**Environmental Factors**	Statement (x1):		

Round 1 "Domain-Level" suggestions (PEHH Version 1)				Round 2 "Domain-Level Suggestions (PEHH Version 2)			
Domain	**Modification category**	**Accepted/Rejected?**	**Reason for Rejection**	**Domain**	**Modification category**	**Accepted/Rejected?**	**Reason for Rejection**
Symptoms	Soil child plays in – contaminated with what? Additions and Re-wording (x3): Hg during pregnancy (i.e. fish eating, dental work) Re-word so patient understands exposures affected brain/lungs Clarification Required (x1): -Addition (x1): What about exposures other than lead? -Addition (x4): General things to consider such as smoke/CO alarms Air exchange Safety features Positive features of env. (i.e. playground, natural env. Etc.). -Addition (x1): Consider possible symptoms -Addition (x1): Proximity to metal	Accepted Rejected fish eating Accepted dental work Rejected Rejected Rejected Accepted - Mercury exposures through fish Rejected Rejected Rejected	 - (2) Fish eating covered in Prenatal section - (3) Provide relevant information upon patient request - (1) Vague - (2) Explored in General Environment - (2) Can be suggested through poor maintenance questions - (7) Covered in medical history	**Affecting Neurodevelopmental Symptoms**	Some env. Exposures in males can have effect on developing child too Comment (x1): Superb section Addition (x2) Set of q's of prenatal & pre conceptual fish eating. What do you store in basement/garage? Is garage attached? Addition (x1) Consider asking about home/herbal/homeopathic remedies that child takes and Q. re. Make-up (e.g. kohl) or skin ointments/	 Accepted Accepted Accepted	

Round 1 "Domain-Level" suggestions (PEHH Version 1)				Round 2 "Domain-Level Suggestions (PEHH Version 2)			
Domain	**Modification category**	**Accepted/Rejected?**	**Reason for Rejection**	**Domain**	**Modification category**	**Accepted/Rejected?**	**Reason for Rejection**
	foundries	Accepted					
Summary Neurodevelopmental Additions -12 suggested modifications -Accepted 4 -Rejected 8				**Summary Neurodevelopmental Exposures:** Additions -3 suggested modifications -Accepted 3			

Appendix D

Expert Responses Re. Item/question Relevancy: Differences Between Domain Scores and Global Relevancy Scores

Differences between the "domain scores" and "global relevancy scores"

Domain	Rater	Domain Score	Global Relevancy Score	Score Difference	Z- Score
d2	3	100	100	0	-1.30
d3	3	100	100	0	-1.30
d4	3	100	100	0	-1.30
d7	3	100	100	0	-1.30
d9	3	100	100	0	-1.30
d6	6	75	75	0	-1.30
d4	7	100	100	0	-1.30
d8	7	100	100	0	-1.30
d9	7	100	100	0	-1.30
d8	9	100	100	0	-1.30
d5	5	76	75	1	-1.22
d2	10	76	75	1	-1.22
d8	4	73	75	-2	-1.14
d8	10	73	75	-2	-1.14
d2	4	72	75	-3	-1.06
d6	4	72	75	-3	-1.06
d9	9	97	100	-3	-1.06
d1	10	78	75	3	-1.06
d4	2	71	75	-4	-0.98
d1	3	96	100	-4	-0.98
d1	5	96	100	-4	-0.98
d3	2	81	75	6	-0.81
d6	3	94	100	-6	-0.81
d6	7	94	100	-6	-0.81
d8	3	93	100	-7	-0.73
d7	10	82	75	7	-0.73
d5	4	67	75	-8	-0.65
d9	10	67	75	-8	-0.65
d7	7	91	100	-9	-0.57
d2	7	90	100	-10	-0.49
d5	7	90	100	-10	-0.49
d2	2	86	75	11	-0.41
d7	6	64	75	-11	-0.41
d3	7	88	100	-12	-0.33
d1	9	87	75	12	-0.33
d6	2	88	75	13	-0.25
d3	6	88	75	13	-0.25
d1	7	87	100	-13	-0.25
d3	8	88	75	13	-0.25
d5	8	62	75	-13	-0.25
d6	9	88	75	13	-0.25
d4	10	88	75	13	-0.25
d6	10	88	75	13	-0.25
d9	8	89	75	14	-0.17
d2	9	86	100	-14	-0.17
d2	6	90	75	15	-0.09
d7	1	91	75	16	-0.01
d1	2	91	75	16	-0.01
d7	2	91	75	16	-0.01

d1	6	57	75	-18	0.15
d8	6	93	75	18	0.15
d4	9	82	100	-18	0.15
d4	4	94	75	19	0.23
d4	6	94	75	19	0.23
d3	9	81	100	-19	0.23
d5	10	95	75	20	0.31
d2	5	97	75	22	0.48
d2	8	97	75	22	0.48
d6	8	97	75	22	0.48
d5	3	76	100	-24	0.64
d5	9	76	100	-24	0.64
d1	1	100	75	25	0.72
d2	1	100	75	25	0.72
d3	1	100	75	25	0.72
d4	1	100	75	25	0.72
d5	1	100	75	25	0.72
d6	1	100	75	25	0.72
d8	1	100	75	25	0.72
d9	1	100	75	25	0.72
d5	2	100	75	25	0.72
d8	2	100	75	25	0.72
d9	2	100	75	25	0.72
d7	4	100	75	25	0.72
d3	5	100	75	25	0.72
d4	5	100	75	25	0.72
d9	5	100	75	25	0.72
d9	6	100	75	25	0.72
d1	8	100	75	25	0.72
d4	8	100	75	25	0.72
d7	8	100	75	25	0.72
d8	8	100	75	25	0.72
d7	9	100	75	25	0.72
d3	10	100	75	25	0.72
d1	4	74	100	-26	0.80
d5	6	43	75	-32	1.28
d3	4	63	100	-37	1.69
d6	**5**	**100**	**50**	**50***	**2.73**
d7	**5**	**100**	**50**	**50***	**2.73**
d8	**5**	**100**	**50**	**50***	**2.73**
d9	**4**	**81**	**25**	**56***	**3.22**

*Indicates scores differences beyond two standard deviations from the mean, representing *inconsistent* expert response sets.

Appendix E

Pediatric Environmental Health History- Version 2

Pediatric Environmental Health History (PEHH) Questionnaire

General Information

1. Date form filled

2. Chart #

3. PHN #

4. Child's Name _____

5. Gender ☐ Male ☐ Female

6. Date of birth _____

7. How did you find this clinic? Physician referral, internet..etc.?

8. Mother's country of origin

9. Father's country of origin

10. Years family has been in Canada (Mom, Dad and Child)

11. Marital status
- ☐ Never legally married
- ☐ Legally married (and not separated)
- ☐ Separated, but still legally married
- ☐ Divorced
- ☐ Widowed
- ☐ Living with a common law partner

12. Has your child lived in another country? ☐ Y ☐ N

13. Name of country _____

14. Length of time child lived in that country? _____

15. How many people including biological relatives and friends live in your current household? _____

16. Reason for referral _____

17. How long has your child had symptoms (if any)? _____

18. What are these symptoms? _____

19. Are you concerned about any environmental exposures/issues? _____

20. What other conditions does your child have, if any? _____

21. Do any members of the household have similar symptoms/conditions as your child? ☐ Y ☐ N

22. If yes, what is your relationship with any persons with similar symptoms/conditions? _____

23. Which extended family members not living in the current household have or had similar symptoms/conditions as your child _____

24. Where does your child spend time? ☐ Home ☐ Daycare/Day Home ☐ School ☐ Other (i.e. Extracurricular activities)

25. Does the child live in more than one household? ☐ Y ☐ N

26. (any details) _____

General Environment

27. Describe the location of your home ☐ Urban ☐ Suburban ☐ Rural

28. (any details) _____

29. Do you rent or own ☐ rent ☐ own

30. Have you moved in the past year? ☐ Y ☐ N

31. (If so, check all that apply). Your last home was: ☐ > 30 years old ☐ near heavy traffic ☐ near gas station ☐ near dry cleaners ☐ near farms ☐ near golf courses ☐ near school ☐ near industry/emissions

32. Approximate age of your home? _____

33. Is your home within 3 blocks of a major road with at least single lane traffic flowing two ways, that is fairly continuous throughout the day? ☐ Y ☐ N

34. Is there heavy traffic within 3 blocks of your home, including a stop light or idling vehicles? ☐ Y ☐ N

35. Is there a gas station or dry cleaner within 3 blocks of your home? ☐ Y ☐ N

36. If yes, check all that apply: ☐ Gas station ☐ Dry cleaner

37. Are there industrial facilities, power plants etc., within 5 kilometers of your home? ☐ Y ☐ N ☐ I don't know

38. Are there nearby farms, parks, golf courses or school yards within 3 blocks of your home? ☐ Y ☐ N

39. If yes, check all that apply: ☐ Farms ☐ Parks ☐ Golf courses ☐ School yards

40. Does your child have any exposure to farm animals? ☐ Y ☐ N

41. Any pesticides used in home/yard? ☐ Y ☐ N

42. Describe the condition of your current home _____

43. Have you done any renovations projects including demolitions, removals, repairs, or replacements? ☐ Y ☐ N

44. If yes, check all that apply: ☐ Demolitions ☐ Removals ☐ Repairs ☐ Replacements

45. (any details) _____

46. What type of flooring do you currently have in your home?	☐ Carpet ☐ Rugs ☐ Hardwood ☐ Tiles ☐ Lino ☐ Stone ☐ Cement
47. Do you use scented personal care products, scented home cleaning products, or air fresheners?	☐ Y ☐ N
48. If yes, check all that apply:	☐ Scented personal care products ☐ Scented home cleaning products ☐ Air fresheners
49. Do you know of any noticeable: peeling paint/water damage/mold that has occurred in your home?	☐ Y ☐ N
50. If yes, check all that apply	☐ Peeling paint ☐ Water damage ☐ Mold
51. Do you smell a musty or moldy odor in your home?	☐ Y ☐ N
52. Do you use a wood fireplace, wood burning stove, pellet stove, kerosene heater, oil furnace, or gas furnace, gas fireplace, gas stove, gas dryer, or propane?	☐ Y ☐ N
53. If yes, check all that apply	☐ Wood fireplace ☐ Wood burning stove ☐ Pellet stove ☐ Kerosene heater ☐ Oil furnace ☐ Gas furnace ☐ Gas fireplace ☐ Gas stove ☐ Gas dryer ☐ Propane
54. Do you have a smoke detector or CO detector?	☐ Y ☐ N
55. If yes, check all that apply	☐ Smoke detector ☐ CO detector ☐ Both
56. Did you ever get your home checked for radon?	☐ Y ☐ N
57. (any details)	_____
58. Does anyone in the child's life smoke?	☐ Y ☐ N
59. Who are the smokers?	_____
60. Where do they smoke?	☐ Indoors ☐ Outdoors ☐ Car
61. Do smokers wash hands or change clothes before interacting with the child?	☐ Y ☐ N
62. (any details)	_____
63. Do you have any pets?	☐ Y ☐ N
64. Are the pets indoors or outdoors, or both?	☐ Indoor ☐ Outdoor ☐ Both

General Environment for Second Household (if applicable)

27.1. Describe the location of your home
☐ Urban ☐ Suburban
☐ Rural

28.1. (any details) _____

29.1. Do you rent or own
☐ rent ☐ own

30.1. Have you moved in the past year?
☐ Y ☐ N

31.1. (If yes, check all that apply). Your last home was:
☐ > 30 years old ☐ near heavy traffic
☐ near gas station ☐ near dry
☐ cleaners near farms near golf courses
☐ near school ☐ near industry/emissions

32.1. Approximate age of your second home? _____

33.1. Is this home within 3 blocks of a major road with at least single lane traffic two ways, that is fairly continuous throughout the day?
☐ Y ☐ N

34.1. Is there heavy traffic within 3 blocks of your second home including a stop light or idling vehicles?
☐ Y ☐ N

35.1. Is there a gas station or dry cleaner within 3 blocks of your home?
☐ Y ☐ N

36.1. If yes, check all that apply
☐ gas station ☐ dry cleaners

37.1. Are there industrial facilities, power plants etc., within 5 kilometers of your home?
☐ Y ☐ N

38.1. Are there nearby farms, parks, golf courses or school yards within 3 blocks of your home?
☐ Y ☐ N

39.1. If yes, check all that apply
☐ Farms ☐ Parks ☐ Golf courses
☐ School yards

40.1. Does your child have any exposure to farm animals?
☐ Y ☐ N

41.1. Any pesticides used in home/yard?
☐ Y ☐ N

42.1. Describe the condition of your second home _____

43.1. Have you done any renovations projects including demolitions, removals, repairs, or replacements?
☐ Y ☐ N

44.1. If yes, check all that apply
☐ Demolitions ☐ Removals
☐ Repairs ☐ Replacements

45.1. (any details) _____

46.1. What type of flooring do you currently have in your second home?
☐ Carpet ☐ Rugs ☐ Hardwood
☐ Tile ☐ Lino ☐ Stone
☐ Cement

47.1. Do you use scented personal care products, scented home cleaning products, or air fresheners?
☐ Y ☐ N

48.1 If yes, check all that apply:
☐ Scented personal care products
☐ Scented home cleaning products
☐ Air fresheners

49.1. Do you know of any noticeable: peeling paint/water damage/mold that has occurred in your second home? ☐ Y ☐ N

50.1. If yes, check all that apply ☐ Peeling paint ☐ Water damage ☐ Mould

51.1. Do you smell a musty or moldy odor in your home? ☐ Y ☐ N

52.1. Do you use a wood fireplace, wood burning stove, pellet stove, kerosene heater, oil furnace, gas furnace, gas fireplace, gas stove, gas dryer, or propane in second home? ☐ Y ☐ N

53.1. If yes, check all that apply ☐ Wood fireplace ☐ Wood burning stove ☐ Pellet stove ☐ Kerosene heater ☐ Oil furnace ☐ Gas furnace ☐ Gas fireplace ☐ Gas stove ☐ Gas dryer ☐ Propane

54.1. Do you have a smoke detector or CO detector in your second home? ☐ Y ☐ N

55.1. If yes, check all that apply ☐ Smoke detector ☐ CO detector ☐ Both

56.1. Did you ever get your second home checked for radon? ☐ Y ☐ N

57.1. (any details) _____

58.1. Does anyone in the child's life smoke in this second household? ☐ Y ☐ N

59.1. Who smokes in the second household? _____

60.1. Where do they smoke? ☐ Indoor ☐ Outdoor ☐ Car

61.1. Do smokers wash hands or change clothes before interacting with the child? ☐ Y ☐ N

62.1. (any details) _____

63.1. Do you have pets in the second home? ☐ Y ☐ N

64.1. Are your pets indoors or outdoors, or both? ☐ Indoor ☐ Outdoor ☐ Both

School Environment

65. Approximate age of the building? _____

66. Describe the location of the school ☐ Urban ☐ Suburban ☐ Rural

67. How does your child get to school? ☐ Walk ☐ Bicycle ☐ Skateboard ☐ Rollerblade ☐ Car ☐ Bus ☐ Taxi ☐ Train

68. Is this school within 3 blocks of a major road with at least single lane traffic two ways, that is fairly continuous throughout the day? ☐ Y ☐ N

69. Is this school within 3 blocks of heavy traffic, including a stop light, or idling vehicles or school buses? ☐ Y ☐ N

70. (If yes, check all that apply): The school is near: ☐ Stop light ☐ 4-way stop ☐ Idling vehicles ☐ Idling school buses

71. Is there a gas station or dry cleaner within 3 blocks of the school? ☐ Y ☐ N

72. If yes, check all that apply ☐ Gas station ☐ Dry Cleaners

73. Are there nearby farms, parks, golf courses or school yards within 3 blocks of the building? ☐ Y ☐ N

74. If yes, check all that apply ☐ Farms ☐ Parks ☐ Golf courses ☐ School yards

75. Are there industrial facilities, power plants etc., that are 5 kilometers of the school? ☐ Y ☐ N

76. Any pesticides used inside, outside, or in the yard of school building? ☐ Y ☐ N ☐ I don't know

77. Are there carpets in the classroom? ☐ Y ☐ N

78. Are classrooms in a portable? ☐ Y ☐ N

79. Do you know of any renovation projects of the school building including demolitions, removals, repairs, or replacements? ☐ Y ☐ N

80. If yes, check all that apply ☐ Demolitions ☐ Removals ☐ Repairs ☐ Replacements

81. Do you know of any noticeable: peeling paint/water damage/mold that has occurred in the school building/portable? ☐ Y ☐ N

82. (If yes, check all that apply) ☐ Peeling paint ☐ Water damage ☐ Mold

83. Do you smell a musty or moldy odor in the school building/portable? ☐ Y ☐ N

84. Has your child complained about any smells from his/her surroundings in school? ☐ Y ☐ N

85. (any details) _____

86. Are there pets in school? ☐ Y ☐ N

87. (any details) _____

88. How is the building or portable heated? _____

89. Are the original symptoms worse when your child is at school? ☐ Y ☐ N

90. (any details) _____

Daycare/Day Home Environment

91. Does your child attend daycare or a day home babysitter?	☐ Y ☐ N
92. If yes, check all that apply	☐ Daycare ☐ Babysitter
93. How many hours per week does your child attend?	_____
94. How many children attend?	_____
95. Approximate age of the care building?	_____
96. Describe the location of the building	☐ Urban ☐ Suburban ☐ Rural
97. (any details)	_____
98. Is the care building within 3 blocks of a major road with at least single lane traffic two ways, that is fairly continuous throughout the day?	☐ Y ☐ N
99. Is there heavy traffic within 3 blocks of the care building, including a stop light, or idling vehicles?	☐ Y ☐ N
100. Is there a gas station or dry cleaner within 3 blocks of the building?	☐ Y ☐ N
101. If yes, check all that apply	☐ Gas station ☐ Dry cleaner
102. Are there industrial facilities, power plants etc., that are within 5 kilometers of the care building?	☐ Y ☐ N
103. Are there nearby farms, parks, golf courses or school yards within 3 blocks of the building?	☐ Y ☐ N
104. If yes, check all that apply	☐ Farms ☐ Parks ☐ Golf courses ☐ School yards
105. Any pesticides used inside or in yard of care building?	☐ Y ☐ N ☐ I don't know
106. Do you know of any renovation projects of the care building including demolitions, removals, repairs, or replacements?	☐ Y ☐ N
107. If yes, check all that apply	☐ Renovations ☐ New carpets ☐ Paint ☐ Floor coverings ☐ Floor finishings
108. Do you know of any noticeable: peeling paint/water damage/mold that has occurred in the care building/home?	☐ Y ☐ N
109. If yes, check all that apply	☐ Peeling paint ☐ Water damage ☐ Mold
110. Do you smell a musty or moldy odor in the care building/home?	☐ Y ☐ N
111. Do you think there are any smells that bother your child from his/her surroundings in the care building/home?	☐ Y ☐ N

112. (any details) _____

113. Do any of the caregivers smoke? ☐ Y ☐ N ☐ I don't know

114. If yes, check all that apply ☐ Indoor ☐ Outdoor ☐ I don't know

115. Are there pets in the daycare/home ☐ Y ☐ N

116. (any details) _____

Lifestyle

117. What is mother's current occupation? _____

118. What is mother's parental age? _____

119. What is father's current occupation? _____

120. What is father's parental age _____

121. Have these jobs changed in the past? ☐ Y ☐ N

122. (any details) _____

123. What level of education has the mother received?
☐ High school diploma or equivalent
☐ Registered apprenticeship or other trades certificate or diploma
☐ College, CEGEP, or other non-university diploma
☐ University certificate, diploma, or degree
☐ I don't know

124. What level of education has the father received?
☐ High school diploma or equivalent
☐ Registered apprenticeship or other trades certificate or diploma
☐ College, CEGEP, or other non-university diploma
☐ University certificate, diploma, or degree
☐ I don't know

125. Do you currently live in a lone parent family household? ☐ Y ☐ N

126. Have there been any issues causing ongoing or short term stress/grief? ☐ Y ☐ N

127. If so, how long? (please specify years or months) _____

128. Issue? _____

129. About how much time daily does your child spend outside? _____

130. Where outside is most of the time spent? Please check all that apply: ☐ Yard ☐ Playground ☐ Park ☐ Organized sports

131. What hobbies or sports are the family members involved in? _____

132. Do you use hot tubs/swimming pools more than once per month? ☐ Y ☐ N

133. If yes, check all that apply ☐ Hot tubs ☐ Swimming pools

134. Approximately how many hours/day in total does your child spend watching TV, playing video games, or on the computer? _____

135. Does your child have a cell phone? ☐ Y ☐ N

136. Is the phone used more for talking or for texting? _____

Prenatal Exposures

137. Weeks of gestation at birth? _____

138. Birth Weight _____

139. Were there any problems with the pregnancy? _____

140. Mother's occupation during pregnancy _____

141. (any details) _____

142. Father's occupation during pregnancy _____

143. (any details) _____

144. Approximate age of your home during pregnancy? _____

145. During pregnancy, was your home within 3 blocks of a major road with at least single lane traffic two ways, that is fairly continuous throughout the day? ☐ Y ☐ N

146. During pregnancy, was there heavy traffic within 3 blocks of your home, including a stop light, or idling vehicles? ☐ Y ☐ N

147. Was there a gas station or dry cleaner within 3 blocks of your home? ☐ Y ☐ N

148. If yes, check all that apply ☐ Gas station ☐ Dry cleaner

149. Were there industrial facilities, power plants etc., within 5 kilometers of your home during pregnancy? ☐ Y ☐ N

150. Were there nearby farms, parks, golf courses, or school yards within 3 blocks of your home? ☐ Y ☐ N

151. If yes, check all that apply ☐ Farms ☐ Parks ☐ Golf courses ☐ School yards

152. Any pesticides used in home/yard? ☐ Y ☐ N

153. Have you done any renovation projects including demolitions, removals, repairs, or replacements, during pregnancy? ☐ Y ☐ N

154. If yes, check all that apply ☐ Demolitions ☐ Removals ☐ Repairs ☐ Replacements

155. Did you know of any noticeable: peeling paint/water damage/mould that had occurred in your home during pregnancy? ☐ Y ☐ N

156. If yes, check all that apply ☐ Peeling paint ☐ Water damage ☐ Mould

157. Did you smell a musty or moldy odor in your home during pregnancy? ☐ Y ☐ N

158. Did the mother smoke during her pregnancy? ☐ Y ☐ N

159. Did the father smoke during the mother's pregnancy? ☐ Y ☐ N

160. If yes, did he smoke inside, outside, or in the car? ☐ Inside ☐ Outside ☐ In the car

161. (any details) _____

162. Were you exposed to cigarette smoke from anywhere else while you were pregnant? _____

163. Did the mother use any prescription or over the counter medications? ☐ Y ☐ N

164. If yes, please specify _____

165. Was this continued during breastfeeding? ☐ Y ☐ N

166. Did the mother take any complementary or alternative therapies? (i.e vitamins, minerals, herbs, homeopathic remedies etc.) ☐ Y ☐ N

167. If yes, please specify: _____

168. Was this continued during breastfeeding? ☐ Y ☐ N

169. Any other drug use (of prescription or illicit drugs)? ☐ Y ☐ N

170. (any details) _____

171. Was this continued during breastfeeding? ☐ Y ☐ N

172. Any alcohol during pregnancy? ☐ Y ☐ N

173. If yes, how frequent and how much? _____

174. Hobbies or sports during pregnancy? _____

175. Seafood/fish/sea mammals meals per month _____

176. (any details) _____

Infancy Diet

177. Was your baby fed by breast, bottle or by both? ☐ Breast Fed ☐ Bottle ☐ Both

178. If breast fed, how long was your child breast fed? (Please specify years or month) _____

179. Did/does your child use a soother? ☐ Y ☐ N

180. At what age did your child start eating manufactured foods? _____

181. Has your child had any unusual dietary or feeding problems? ☐ Y ☐ N

182. If yes, please specify _____

183. Does your child ingest any non-food items? _____

184. How many cups of milk does your child drink per day? _____

185. Fast food meals per month? _____

186. Seafood/fish/sea mammals meals per month? _____

187. Does your child eat fruits and vegetables? ☐ Y ☐ N

188. About how many servings per day? _____

189. Are the fruits and/or vegetables peeled? ☐ Y ☐ N

190. Does your child regularly consume organic foods? ☐ Y ☐ N

191. (any details) _____

192. Does your child eat a source of protein? ☐ Y ☐ N

193. (any details) _____

Environmental Factors Affecting Respiratory Symptoms

194. Were your furnace and ducts professionally cleaned in the past year? ☐ Y ☐ N ☐ I don't know

195. Does your child sleep with stuffed animals? ☐ Y ☐ N

196. Does he sleep with feathers or Down pillows or comforters? ☐ Y ☐ N

197. How often do you need to vacuum, mop, or dust your home? _____

198. (any details)? _____

199. How often is the bedding washed per month _____

200. Any bedwetting? ☐ Y ☐ N

201. Is there carpeting in the child's room? ☐ Y ☐ N

202. Does the child have clutter in their room? ☐ Y ☐ N

203. Is your child exposed to perfumes, scented products, or harsh cleaners? ☐ Y ☐ N

204. If yes, check all that apply ☐ Perfumes ☐ Scented products ☐ Harsh cleaners

205. If yes, is your child bothered by these scented products? ☐ Y ☐ N

206. In which way(s)? _____

207. Are there any indications of insect or mice pests in your home? ☐ Y ☐ N ☐ I don't know

208. If yes, check all that apply ☐ Insects ☐ Mice

209. Do you use insecticides or rodenticides? ☐ Y ☐ N

210. Is your child exposed to smoke from any wood? (i.e. forest fires, camp fires etc.) ☐ Y ☐ N

211. If yes, what type of wood and when? _____

212. Does he experience seasonal symptoms? (i.e. cough, or runny nose)? ☐ Y ☐ N

213. If yes, please specify _____

214. Do you monitor the Air Quality Health Index? ☐ Y ☐ N

215. Is there anything you feel that might make your child's symptoms worse? _____

Environmental Factors Affecting Neurological Symptoms

216. Does your child tend to put everything in his/her mouth? ☐ Y ☐ N

217. If yes, how often? _____

218. Is there any old chipped flaking paint, for example, around window sills, railings, doors, or anywhere in the child's environment? ☐ Y ☐ N ☐ I don't know

219. Are there lead water pipes in your home, school or daycare? ☐ Y ☐ N ☐ I don't know

220. In pregnancy, did your home or workplace have lead water pipes? ☐ Y ☐ N ☐ I don't know

221. Do you regularly eat wild meat shot with lead bullets/an ethnic diet with imported spices from Asia/ candy from Mexico? ☐ Y ☐ N

222. If yes, check all that apply ☐ Wild meat Ethnic☐ diet with imported spices ☐ Candy from Mexico

223. During pregnancy? ☐ Y ☐ N

224. Do you use any ethnic, herbal remedies, or products for ceremonial purposes? ☐ Y ☐ N

225. If yes, please specify _____

226. During pregnancy? ☐ Y ☐ N

227. (any details) _____

228. Do you cook, store or serve food in painted ceramic cookware or pewter? ☐ Y ☐ N

229. Does your child own inexpensive metal jewelry? ☐ Y ☐ N

230. If yes, do you ever see them putting it in their mouth? ☐ Y ☐ N ☐ I don't know

231. Are you aware of any lead contained items in your home such as candles, or mini blinds? ☐ Y ☐ N

232. If yes, please specify _____

233. Does the child have access to old fishing tackle? ☐ Y ☐ N ☐ I don't know

234. Does your child have access to battery operated toys, watches, flashlights, glass thermometers, compact fluorescent lights? ☐ Y ☐ N ☐ I don't know

235. If yes, please specify _____

236. Do you ever see them put it in their mouth? ☐ Y ☐ N

237. Does your child play with imported toys (i.e brightly painted)? ☐ Y ☐ N ☐ I don't know

238. If yes, which ones? _____

239. If yes, do you ever see them putting it in their mouth ☐ Y ☐ N

240. Do you have old painted furniture? ☐ Y ☐ N

241. Has your child regularly left teeth marks on the furniture ☐ Y ☐ N ☐ I don't know

242. Have the mother, or father, or any household members ever worked in battery manufacturing/recycling, radiator repairs, lead smelting, brass and bronze foundry, demolitions/renovations of old property, firing range or pottery glazing? ☐ Y ☐ N ☐ I don't know

243. If yes, please specify _____

244. Any history of metal intoxication in child's mother prior to pregnancy ☐ Y ☐ N ☐ I don't know

245. (any details) _____

246. Did the mother ever have dental work done on any mercury amalgams during pregnancy? ☐ Y ☐ N ☐ I don't know

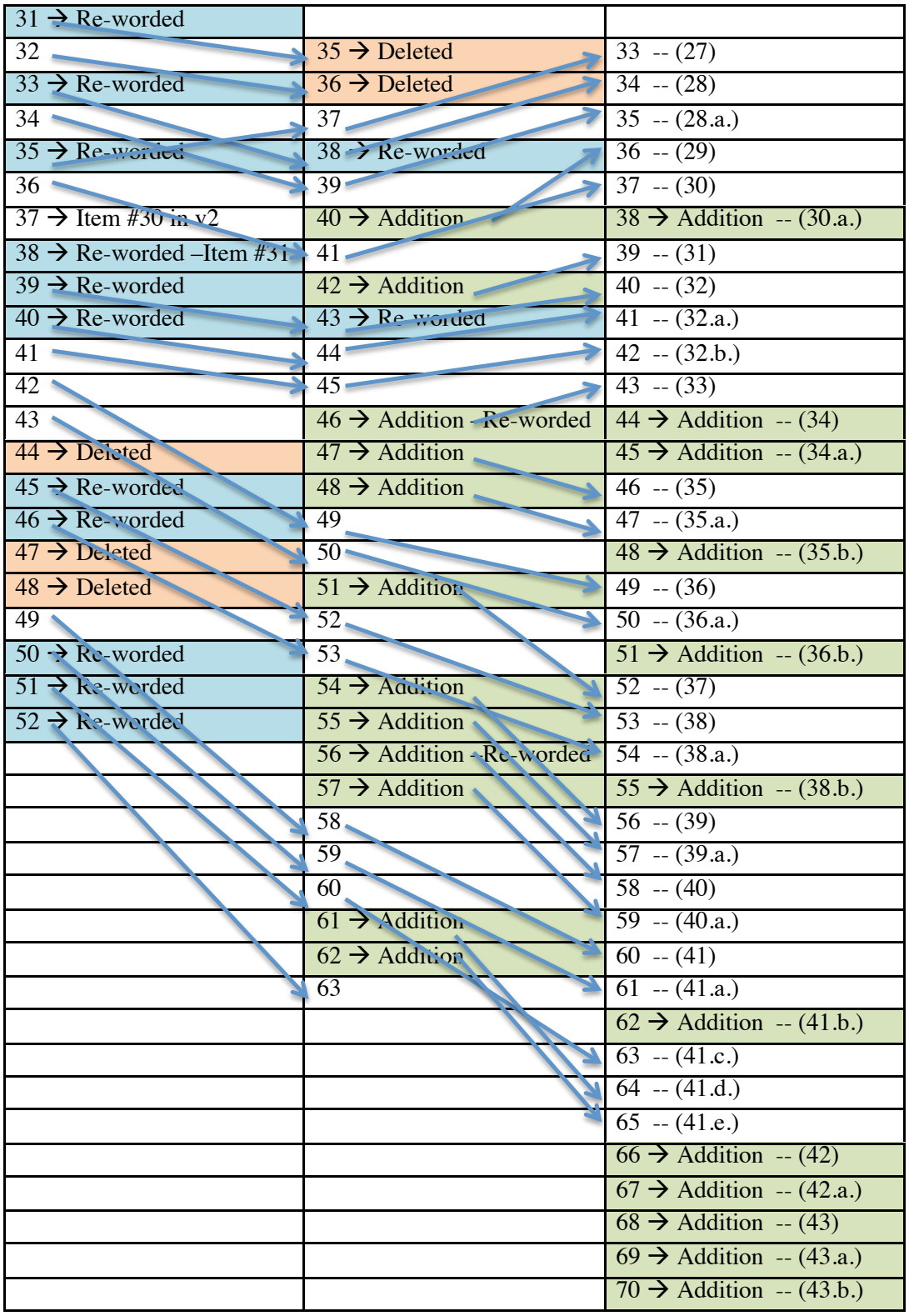
247. Has the mother or the child ever lived in an area where metal contamination was an issue (i.e. mines, foundries, tail dump sites, leaded gasoline, etc.)? ☐ Y ☐ N ☐ I don't know

248. (any details) _____

Appendix F

Item Modification Mapping

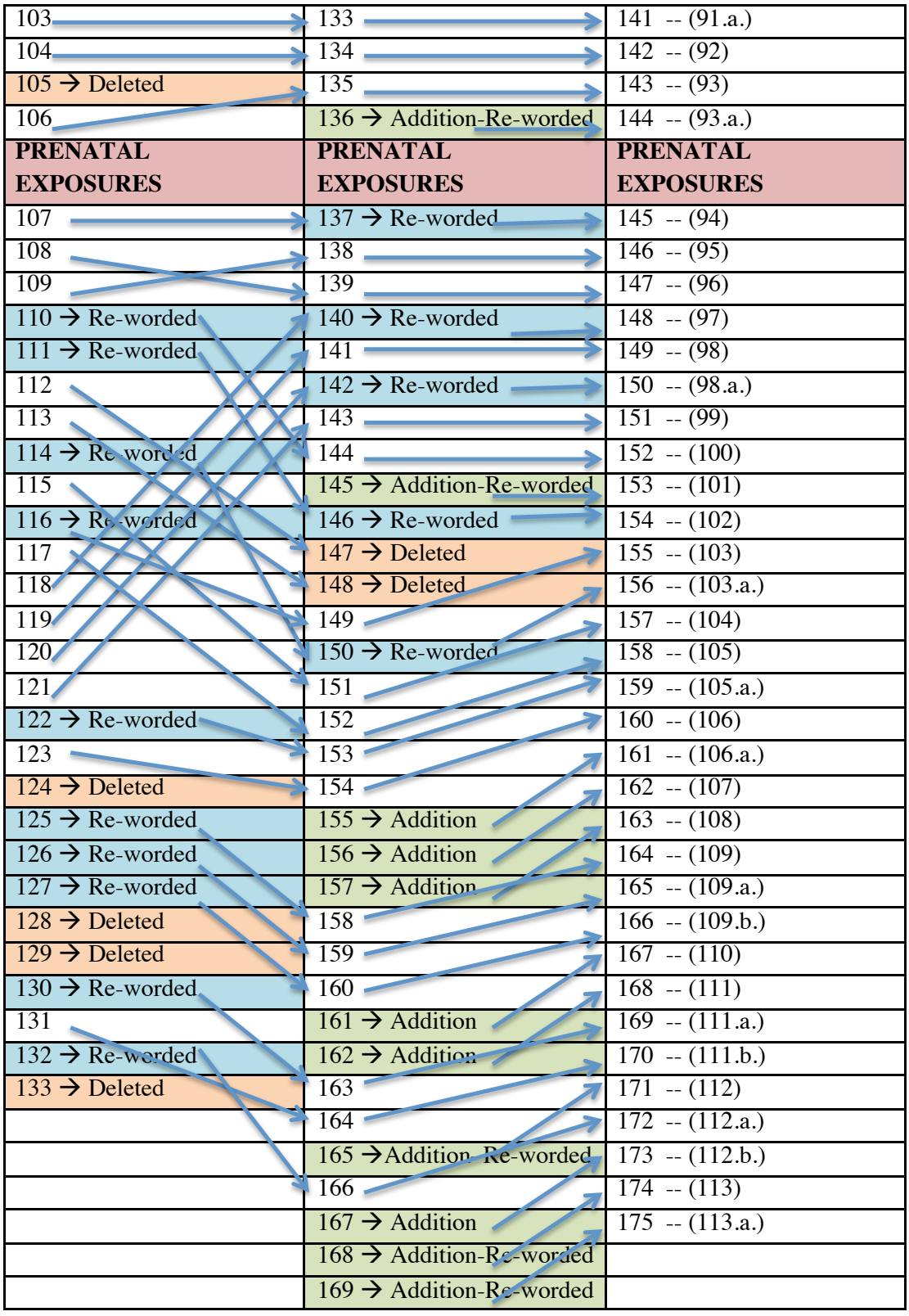
Version 1	Version 2	Version 3
DEMOGRAPHICS	**GENERAL INFORMATION**	**GENERAL INFORMATION**
1	1	1 -- (1)
2	2	2 -- (2)
3	3	3 -- (3)
4	4	4 -- (4)
5	5	5 -- (5)
6	6	6 -- (6)
7 → Re-worded	7	7 -- (7)
8	8	8 -- (8)
9	9 → Addition	9 -- (9)
10	10	10 -- (10)
11	11 → Re-worded	11 – (11)
12	12 → Re-worded	12 – (12)
13	13 → Re-worded	13 – (12.a.)
14 → Re-worded	14 →Addition	14 – (12.b.)
15 → Re-worded	15	15 – (13)
16 → Re-worded	16	16 – (14)
17 → Deleted	17	17 – (15)
18	18 → Addition	18 – (15.a.)
19 → Deleted	19	19 – (16)
20 → Re-worded	20	20 – (17)
21 → Deleted	21	21 – (18)
22	22	22 – (18.a.)
23	23 → Re-worded	23 – (19)
	24	24 – (20)
	25	25 – (21)
	26	26 – (21.a.)
GENERAL ENVIRONMENT	**GENERAL ENVIRONMENT**	**GENERAL ENVIRONMENT**
24	27	27 -- (22)
25	28	28 -- (22.a.)
26	29 → Re-worded	29 -- (23)
27	30 → Item #74 in v3	30 -- (24)
28	31 → Deleted	31 -- (25)
29 → Re-worded	32 → Re-worded	32 -- (26)
30 → Re-worded	33 → Addition	
	34 → Re-worded	



31 → Re-worded		
32	35 → Deleted	33 -- (27)
33 → Re-worded	36 → Deleted	34 -- (28)
34	37	35 -- (28.a.)
35 → Re-worded	38 → Re-worded	36 -- (29)
36	39	37 -- (30)
37 → Item #30 in v2	40 → Addition	38 → Addition -- (30.a.)
38 → Re-worded –Item #31	41	39 -- (31)
39 → Re-worded	42 → Addition	40 -- (32)
40 → Re-worded	43 → Re-worded	41 -- (32.a.)
41	44	42 -- (32.b.)
42	45	43 -- (33)
43	46 → Addition - Re-worded	44 → Addition -- (34)
44 → Deleted	47 → Addition	45 → Addition -- (34.a.)
45 → Re-worded	48 → Addition	46 -- (35)
46 → Re-worded	49	47 -- (35.a.)
47 → Deleted	50	48 → Addition -- (35.b.)
48 → Deleted	51 → Addition	49 -- (36)
49	52	50 -- (36.a.)
50 → Re-worded	53	51 → Addition -- (36.b.)
51 → Re-worded	54 → Addition	52 -- (37)
52 → Re-worded	55 → Addition	53 -- (38)
	56 → Addition - Re-worded	54 -- (38.a.)
	57 → Addition	55 → Addition -- (38.b.)
	58	56 -- (39)
	59	57 -- (39.a.)
	60	58 -- (40)
	61 → Addition	59 -- (40.a.)
	62 → Addition	60 -- (41)
	63	61 -- (41.a.)
		62 → Addition -- (41.b.)
		63 -- (41.c.)
		64 -- (41.d.)
		65 -- (41.e.)
		66 → Addition -- (42)
		67 → Addition -- (42.a.)
		68 → Addition -- (43)
		69 → Addition -- (43.a.)
		70 → Addition -- (43.b.)

	63	71 -- (44)
	64 → Addition	72 → Addition -- (44.a.)
		73 -- (44.b.)
		74 – Item #30 in v2 – (45)
SCHOOL ENVIRONMENT	**SCHOOL ENVIRONMENT**	**SCHOOL ENVIRONMENT**
53 → Re-worded	65	75 -- (46)
54 → Re-worded	66	76 -- (47)
55 → Re-worded	67 → Addition –Re-worded	77 -- (48)
56	68 → Addition –Re-worded	78 -- (49)
57 → Re-worded	69 → Re-worded	79 -- (50)
58	70 → Addition	80 -- (50.a.)
59 → Re-worded	71 → Deleted	81 -- (51)
60 → Re-worded	72 → Deleted	82 -- (51.a.)
61	73 → Re-worded	83 -- (52)
62	74	84 -- (53)
63 → Re-worded	75 → Re-worded	85 -- (54)
64 → Re-worded	76	86 -- (55)
65	77	87 -- (56)
66	78	88 -- (56.a.)
67 → Deleted	79	89 -- (57)
68	80	90 -- (57.a.)
	81 → Addition	91 -- (58)
	82 → Addition	92 -- (59)
	83 → Addition	93 -- (59.a.)
	84	94 -- (60)
	85 → Addition	95 -- (60.a.)
	86	96 -- (61)
	87 → Addition	97 -- (61.a.)
	88 → Addition	98 -- (62)
	89 → Addition –Re-worded	99 -- (63)
	90 → Addition	100 -- (63.a.)
DAYCARE/DAY HOME ENVIRONMENT	**DAYCARE/DAY HOME ENVIRONMENT**	**DAYCARE/DAY HOME ENVIRONMENT**
69 → Re-worded	91 → Re-worded	101 -- (64)
70	92 → Re-worded	102 -- (64.a.)
71 → Re-worded	93 → Addition	103 -- (65)
	94 → Addition	104 -- (66)
	95	105 -- (67)

72	96	106 -- (68)
73	97	107 -- (68.a.)
74 → Re-worded	98 → Addition	108 -- (69)
75 → Re-worded	99 → Re-worded	109 -- (70)
76	100 → Deleted	110 -- (71)
77 → Re-worded	101 → Deleted	111 -- (72)
78	102	112 -- (72.a.)
79 → Re-worded	103→ Re-worded	113 -- (73)
80	104	114 -- (74)
81 → Re-worded	105	115 -- (74.a.)
82 → Re-worded	106	116 -- (75)
83 → Deleted	107	117 -- (75.a.)
84	108 → Addition	118 -- (76)
85	109 → Addition	119 -- (77)
	110 → Addition	120 -- (77.a.)
	111 → Addition	121 -- (78)
	112 → Addition	122 -- (78.a.)
	113	123 -- (79)
	114	124 -- (79.a.)
	115 → Addition	
	116 →Addition–Re-worded	
LIFESTYLE	**LIFESTYLE**	**LIFESTYLE**
86 → Re-worded	117	125 -- (80)
87 → Re-worded	118 → Re-worded	126 -- (81)
88 → Re-worded	119 → Re-worded	127 -- (82)
89 → Re-worded	120 → Re-worded	128 -- (83)
90 → Deleted	121 → Re-worded	129 -- (84)
91 → Re-worded	122	130 -- (84.a.)
92	123	131 -- (85)
93 → Re-worded	124	132 -- (86)
94	125 → Re-worded	133 -- (87)
95 → Deleted	126	134 -- (88)
96	127	135 -- (88.a.)
97	128 → Re-worded	136 -- (88.b.)
98	129	137 -- (89)
99	130 → Addition	138 -- (89.a.)
100	131	139 -- (90)
101	132 → Re-worded	140 -- (91)
102 → Re-worded		


103
104
105 → Deleted
106
PRENATAL EXPOSURES
107
108
109
110 → Re-worded
111 → Re-worded
112
113
114 → Re-worded
115
116 → Re-worded
117
118
119
120
121
122 → Re-worded
123
124 → Deleted
125 → Re-worded
126 → Re-worded
127 → Re-worded
128 → Deleted
129 → Deleted
130 → Re-worded
131
132 → Re-worded
133 → Deleted
133
134
135
136 → Addition-Re-worded
PRENATAL EXPOSURES
137 → Re-worded
138
139
140 → Re-worded
141
142 → Re-worded
143
144
145 → Addition-Re-worded
146 → Re-worded
147 → Deleted
148 → Deleted
149
150 → Re-worded
151
152
153
154
155 → Addition
156 → Addition
157 → Addition
158
159
160
161 → Addition
162 → Addition
163
164
165 →Addition-Re-worded
166
167 → Addition
168 → Addition-Re-worded
169 → Addition-Re-worded
141 -- (91.a.)
142 -- (92)
143 -- (93)
144 -- (93.a.)
PRENATAL EXPOSURES
145 -- (94)
146 -- (95)
147 -- (96)
148 -- (97)
149 -- (98)
150 -- (98.a.)
151 -- (99)
152 -- (100)
153 -- (101)
154 -- (102)
155 -- (103)
156 -- (103.a.)
157 -- (104)
158 -- (105)
159 -- (105.a.)
160 -- (106)
161 -- (106.a.)
162 -- (107)
163 -- (108)
164 -- (109)
165 -- (109.a.)
166 -- (109.b.)
167 -- (110)
168 -- (111)
169 -- (111.a.)
170 -- (111.b.)
171 -- (112)
172 -- (112.a.)
173 -- (112.b.)
174 -- (113)
175 -- (113.a.)

	170 → Addition	176 -- (113.b.)
134 → Re-worded	171 → Addition-Re-worded	177 -- (114)
135	172	178 -- (114.a.)
136 → Re-worded	173	179 -- (115)
137 → Deleted	174	180 -- (116)
138	175	181 -- (116.a.)
	176 → Addition	182 -- (116.b.)
INFANCY/CHILDHOOD	**INFANCY DIET**	**INFANCY DIET**
139	177 → Addition	183 -- (117)
140 → Re-worded	178	184 -- (117.a.)
141 → Deleted	179	185 -- (118)
142	180 → Addition-Re-worded	186 -- (118.a.)
143	181	187 -- (119)
144	182	188 -- (120)
145	183 → Addition-Re-worded	189 -- (121)
146	184	190 -- (121.a.)
147	185	191 -- (122)
148	186	192 -- (123)
149	187	193 -- (124)
	188 → Addition	194 -- (125)
	189 → Addition	195 -- (126)
	190 → Addition	196 -- (126.a.)
	191 → Addition-Re-worded	197 -- (126.b.)
	192 → Deleted	198 -- (127)
	193 → Deleted	199 -- (127.a.)
RESPIRATORY SYMPTOMS	**ENV. FACTORS AFFECTING RESPIRATORY SYMPTOMS**	**ENV. FACTORS AFFECTING RESPIRATORY SYMPTOMS**
150	194 → Re-worded	200 -- (128)
151	195	201 → Addition -- (129)
152	196	202 → Addition -- (129.a.)
	197 → Addition	203 → Addition -- (129.b.)
		204 → Addition -- (130)
		205 → Addition -- (130.a.)
		206 → Addition -- (130.b.)
		207 -- (131)
		208 -- (132)
		209 -- (133)

	198 → Re-worded	210 -- (133.a.)
153	199	211 -- (134)
154	200	212 -- (135)
155	201	213 -- (136)
156	202	214 -- (137)
157	203	215 -- (138)
158	204	216 -- (138.a.)
159 → Re-worded	205 → Addition	217 -- (138.b.)
160	206 → Addition	218 -- (138.c.)
161	207	219 -- (139)
162	208	220 -- (139.a.)
163	209	221 -- (139.b.)
164→ Re-worded	210	222 -- (140)
	211	223 -- (140.a.)
	212	224 -- (141)
	213	225 -- (141.a.)
	214 → Addition	226 → Addition -- (142)
	215 → Re-worded	227 -- (142.a)
		228 → Addition -- (142.b.)
		229 -- (143)
NEURODEVELOP-MENTAL SYMPTOMS	**ENV. FACTORS AFFECTING NEURO-DEVELOPMENTAL SYMPTOMS**	**ENV. FACTORS AFFECTING NEURO-DEVELOPMENTAL SYMPTOMS**
165 → Re-worded	216 → Re-worded	230 -- (144)
166 → Re-worded	217 → Addition	231 -- (144.a.)
167 → Re-worded	218 → Re-worded	232 -- (145)
168	219 → Re-worded	233 -- (146)
169	220	234 -- (147)
170	221	235 -- (148)
171	222	236 -- (148.a.)
172 → Re-worded	223	237 -- (148.b.)
173	224 → Re-worded	238 -- (149)
174	225 → Re-worded	239 -- (149.a.)
175	226	240 -- (149.b.)
176	227	241 -- (149.c.)
177	228	242 -- (150)
178	229	243 -- (151)
	230	244 -- (151.a.)

179 → Re-worded	231	245 -- (152)
180	232	246 -- (152.a.)
181 → Deleted	233 → Re-worded	247 -- (153)
182	234	248 -- (154)
183	235	249 -- (154.a.)
184	236 → Addition	250 -- (154.b.)
185 → Deleted	237	251 -- (155)
186 → Re-worded	238	252 -- (155.a.)
187	239	253 -- (155.b.)
188	240	254 -- (156)
189	241	255 -- (157)
190 → Re-worded	242	256 -- (158)
191 → Re-worded	243	257 -- (158.a.)
192	244	258 -- (159)
193 → Deleted	245	259 -- (159.a.)
194 – Item #210 in v2	246 → Addition	260 -- (160)
195 – Item #211 in v2	247	261 -- (161)
196 → Deleted	248	262 -- (161.a.)
197		
198		
199 → Re-worded		
200		

Legend:

	→ Added items
	→ Re-worded items
	→ Deleted items
	→ Items shifted to another domain
--(*)	→ Re-numbered items

Appendix G

Pediatric Environmental Health History – Final Version

Pediatric Environmental Health History (PEHH) Questionnaire

General Information

Study ID _____

General Information

1. Date form filled _____

2. Chart # _____

3. PHN # _____

4. Child's Name _____

5. Gender ☐ Male ☐ Female

6. Date of birth _____

7. How did you find this clinic? Physician referral, internet.. etc.? _____

8. Mother's country of origin _____

9. Father's country of origin _____

10. Years family has been in Canada (Mom, Dad and Child) _____

11. Marital status of parents/guardians
☐ Never legally married
☐ Legally married (and not separated)
☐ Separated, but still legally married
☐ Divorced
☐ Widowed
☐ Living with a common law partner

12. Has your child lived in another country/countries? ☐ Y ☐ N

12.a. Name of country/countries _____

12.b. Length of time child lived in the specified country/countries? (Please indicate months or years) _____

13. How many people including biological relatives and friends live in your current household? _____

14. Reason for referral _____

15. How long has your child had symptoms (if any)? _____

15.a. What are these symptoms? _____

16. Are you concerned about any environmental exposures/issues? _____

17. What other conditions does your child have, if any? _____

18. Do any members of the household have similar symptoms as your child? ☐ Y ☐ N

18.a. If yes, what is the child's relationship to any persons with similar symptoms? _____

19. Which extended family members not living in the current household have or had similar symptoms as your child _____

20. Where does your child spend time? ☐ Home ☐ Daycare/Day Home ☐ School ☐ Other (i.e. Extracurricular activities,work)

21. Does the child live in more than one household? ☐ Y ☐ N

21.a. (any details) _____

General Environment

22. Describe the location of your home ☐ Urban ☐ Suburban ☐ Rural

22.a. (any details) _____

23. Approximate age of your current home? (Specify year built if known) _____

24. Please check all of the following that apply to your current home: Do you rent/own... ☐ Rent ☐ Own ☐ House ☐ Apartment ☐ Duplex ☐ Condo ☐ Attached garage ☐ Unattached garage ☐ No garage

25. Is your current home within 3 blocks (~300m) of a major road with at least single lane traffic flowing two ways, that is fairly continuous throughout the day? ☐ Y ☐ N

26. Is there heavy traffic within 3 blocks (~300m) of your current home, (e.g. including a stop light or idling vehicles)? ☐ Y ☐ N

27. Are there industrial facilities, power plants etc., within 5 kilometers of your current home? ☐ Y ☐ N ☐ I don't know

28. Are there nearby farms, parks, golf courses or school yards within 3 blocks (~300m) of your current home? ☐ Y ☐ N ☐ I don't know

28a. If yes, check all that apply: ☐ Farms ☐ Parks ☐ Golf courses ☐ School yards

29. Does your child have any exposure to farm animals? ☐ Y ☐ N

30. Any pesticides used in home/yard? ☐ Y ☐ N

30.a. If yes, which pesticides are used and how often? _____

31. Describe the condition of your current home _____

32. Have you done any renovations projects on your current home including demolitions, removals, repairs, or replacements? ☐ Y ☐ N

32.a. If yes, check all that apply:
☐ Demolitions ☐ Removals
☐ Repairs ☐ Replacements

32.b. (any details) _____

33. What type of flooring do you currently have in your home? Check all that apply:
☐ Carpet ☐ Rugs ☐ Hardwood
☐ Tiles ☐ Lino ☐ Stone
☐ Cement

34. Do you have any concern about asbestos?
☐ Y ☐ N

34.a. (any details) _____

35. Do you use scented personal care products, scented home cleaning products, or air fresheners?
☐ Y ☐ N

35.a. If yes, check all that apply:
☐ Scented personal care products
☐ Scented home cleaning products
☐ Air fresheners

35.b. Any other chemicals used/stored in the house/garage/basement? _____

36. Do you know of any noticeable: peeling paint/water damage/mold that has occurred in your home?
☐ Y ☐ N

36.a. If yes, check all that apply
☐ Peeling paint ☐ Water damage
☐ Mold

36.b. Where do you see these? _____

37. Do you smell a musty or moldy odor in your home?
☐ Y ☐ N

38. Do you use a wood fireplace, wood burning stove, pellet stove, kerosene heater, oil furnace, or gas furnace, gas fireplace, gas stove, gas dryer, or propane?
☐ Y ☐ N

38.a. If yes, check all that apply
☐ Wood fireplace ☐ Wood burning stove
☐ Pellet stove ☐ Kerosene heater
☐ Oil furnace ☐ Gas furnace
☐ Gas fireplace ☐ Gas stove
☐ Gas dryer ☐ Propane

38.b. Are these well-maintained? _____

39. Do you have a smoke detector or CO detector?
☐ Y ☐ N

39.a. If yes, check all that apply
☐ Smoke detector ☐ CO detector

40. Have you ever had your home checked for radon?
☐ Y ☐ N

40.a. (any details) _____

41. Does anyone in the child's life smoke?
☐ Y ☐ N

41.a. Who are the smokers? _____

41.b. How much do they smoke and how often? _____

41.c. Where do they smoke?
☐ Indoors ☐ Outdoors
☐ Car

41.d. Do smokers wash hands or change clothes before interacting with the child?
☐ Y ☐ N

41.e. (any details) _____

42. Does the child smoke? ☐ Y ☐ N

42.a. If yes, how often do they smoke and how much? _____

43. Any other drug use in the household (e.g. illicit drugs) ☐ Y ☐ N

43.a. If yes, who is using these drugs? _____

43.b. How often and how much is being used? _____

44. Do you have any pets? ☐ Y ☐ N

44.a. What kind(s) of pet(s)? _____

44.b. Are the pets indoors or outdoors, or both? ☐ Indoor ☐ Outdoor ☐ Both

45. Have you moved in the past year? ☐ Y ☐ N

General Environment for Last Home (If applicable)

22.1 Describe the location of your last home ☐ Urban ☐ Suburban ☐ Rural

22.1.a. (any details) _____

23.1. Approximate age of your last home? (Specify year built if known) _____

24.1. Please check all of the following that apply to your last home: Did you rent/own... ☐ Rent ☐ Own ☐ House ☐ Apartment ☐ Duplex ☐ Condo ☐ Attached garage ☐ Unattached garage ☐ No garage

25.1. Was your last home within 3 blocks (~300m) of a major road with at least single lane traffic flowing two ways, that is fairly continuous throughout the day? ☐ Y ☐ N

26.1. Was there heavy traffic within 3 blocks (~300m) of your last home including a stop light or idling vehicles? ☐ Y ☐ N

27.1. Were there industrial facilities, power plants etc., within 5 kilometers of your last home? ☐ Y ☐ N ☐ I don't know

28.1. Were there nearby farms, parks, golf courses or school yards within 3 blocks (~300m) of your last home? ☐ Y ☐ N ☐ I don't know

28.1.a. If yes, check all that apply: ☐ Farms ☐ Parks ☐ Golf Courses ☐ School Yards

29.1. Did your child have any exposure to farm animals in your last home ☐ Y ☐ N

30.1. Any pesticides used in home/yard of your last home ☐ Y ☐ N

30.1.a. If yes, which pesticide(s) were used and how often? _____

31.1. Describe the condition of your last home _____

32.1. Have you done any renovation projects including demolitions, removals, repairs, or replacements in your last home?
☐ Y ☐ N

32.1.a. If yes, check all that apply:
☐ Demolitions ☐ Removals
☐ Repairs ☐ Replacements

32.1.b. (any details)
_____

33.1. What type of flooring did you have in your last home?
☐ Carpet ☐ Rugs ☐ Hardwood
☐ Tiles ☐ Lino ☐ Stone
☐ Cement

34.1. Did you have any concern about asbestos in your last home?
☐ Y ☐ N

34.1.a. (any details)
_____

35.1. Did you use scented personal care products, scented home cleaning products, or air fresheners in your last home?
☐ Y ☐ N

35.1.a. If yes, check all that apply:
☐ Scented personal care products
☐ Scented home cleaning products
☐ Air fresheners

35.1.b. Any other chemicals used/stored in the house/garage/basement of your last home?
_____

36.1. Did you notice any: peeling paint/ water damage/ mold that occurred in your last home?
☐ Y ☐ N

36.1.a. If yes, check all that apply:
☐ Peeling paint ☐ Water damage
☐ Mold

36.1.b. Where did you see these?
_____

37.1. Did you smell a musty or moldy odor in your last home?
☐ Y ☐ N

38.1. Did you use a wood fireplace, wood burning stove, pellet stove, kerosene heater, oil furnace, or gas furnace, gas fireplace, gas stove, gas dryer, or propane?
☐ Y ☐ N

38.1.a. If yes, check all that apply
☐ Wood fireplace ☐ Wood burning stove
☐ Pellet stove ☐ Kerosene heater
☐ Oil furnace ☐ Gas furnace
☐ Gas fireplace ☐ Gas stove
☐ Gas dryer ☐ Propane

38.1.b. Were these well-maintained?
_____

39.1. Did you have a smoke detector or CO detector in your last home?
☐ Y ☐ N

39.1.a. If yes, check all that apply
☐ Smoke detector ☐ CO detector

40.1. Have you ever had your home checked for radon?
☐ Y ☐ N

40.1.a. (any details)
_____

41.1. Did anyone in the child's life smoke in the last home?
☐ Y ☐ N

41.1.a Who are the smokers?
_____

41.1.b. How much do they smoke and how often?
_____

41.1.c. Where do they smoke? ☐ Indoors ☐ Outdoors ☐ Car

41.1.d. Did smokers wash hands or change clothes before interacting with the child? ☐ Y ☐ N

41.1.e. (any details) _____

42.1. Did the child smoke in the last home? ☐ Y ☐ N

42.1.a. If yes, how often did he/she smoke and how much? _____

43.1. Any other drug use in the last home (e.g. illicit drugs) ☐ Y ☐ N

43.1.a. If yes, who was using these drugs? _____

43.1.b. How often and how much was being used? _____

44.1. Did you have any pets in the last home? ☐ Y ☐ N

44.1.a What kind(s) of pet(s)? _____

44.1.b. Were the pet(s) indoors, outdoors, or both? ☐ Indoors ☐ Outdoors ☐ Both

General Environment for Second Household (if applicable)

22.2. Describe the location of your second home ☐ Urban ☐ Suburban ☐ Rural

22.2.a. (any details) _____

23.2. Approximate age of the child's second home? (Specify year built if known) _____

24.2. Please check all of the following that apply to the child's second home: Do you rent/own... ☐ Rent ☐ Own ☐ House ☐ Apartment ☐ Duplex ☐ Condo ☐ Attached garage ☐ Unattached garage ☐ No garage

25.2. Is this second home within 3 blocks of a major road with at least single lane traffic two ways, that is fairly continuous throughout the day? ☐ Y ☐ N

26.2. Is there heavy traffic within 3 blocks of your second home including a stop light or idling vehicles? ☐ Y ☐ N

27.2. Are there industrial facilities, power plants etc., within 5 kilometers of your home? ☐ Y ☐ N ☐ I don't know

28.2. Are there nearby farms, parks, golf courses or school yards within 3 blocks of your home? ☐ Y ☐ N ☐ I don't know

28.2.a. If yes, check all that apply ☐ Farms ☐ Parks ☐ Golf courses ☐ School yards

29.2. Does your child have any exposure to farm animals? ☐ Y ☐ N

30.2. Any pesticides used in home/yard? ☐ Y ☐ N

30.2.a. If yes, which pesticides are used and how often? _____

31.2. Describe the condition of your second home _____

32.2. Have you done any renovations projects including demolitions, removals, repairs, or replacements? ☐ Y ☐ N

32.2.a. If yes, check all that apply ☐ Demolitions ☐ Removals ☐ Repairs ☐ Replacements

32.2.b. (any details) _____

33.2. What type of flooring is there currently in the child's second home? ☐ Carpet ☐ Rugs ☐ Hardwood ☐ Tile ☐ Lino ☐ Stone ☐ Cement

34.2. Do you have any concern about asbestos in the child's second home? ☐ Y ☐ N

34.2.a. (any details) _____

35.2. Are any scented personal care products, scented home cleaning products, or air fresheners used in the child's second home? ☐ Y ☐ N ☐ I don't know

35.2.a. If yes, check all that apply: ☐ Scented personal care products ☐ Scented home cleaning products ☐ Air fresheners

35.2.b. Any other chemicals used/stored in the house/garage/basement? _____

36.2. Do you know of any noticeable: peeling paint/water damage/mold that has occurred in your second home? ☐ Y ☐ N

36.2.a. If yes, check all that apply ☐ Peeling paint ☐ Water damage ☐ Mould

36.2.b. Where do you see these? _____

37.2. Do you smell a musty or moldy odor in your home? ☐ Y ☐ N

38.2. Do you use a wood fireplace, wood burning stove, pellet stove, kerosene heater, oil furnace, gas furnace, gas fireplace, gas stove, gas dryer, or propane in the child's second home? ☐ Y ☐ N

38.2.a. If yes, check all that apply ☐ Wood fireplace ☐ Wood burning stove ☐ Pellet stove ☐ Kerosene heater ☐ Oil furnace ☐ Gas furnace ☐ Gas fireplace ☐ Gas stove ☐ Gas dryer ☐ Propane

38.2.b. Are these well-maintained? _____

39.2. Do you have a smoke detector or CO detector in your second home? ☐ Y ☐ N

39.2.a. If yes, check all that apply ☐ Smoke detector ☐ CO detector

40.2. Did you ever get your second home checked for radon? ☐ Y ☐ N

40.2.a. (any details) _____

41.2. Does anyone in the child's life smoke in this second household? ☐ Y ☐ N

41.2.a. Who smokes in the second household? _____

41.2.b. How much do they smoke and how often? _____

41.2.c. Where do they smoke? ☐ Indoors ☐ Outdoors ☐ Car

41.2.d. Do smokers wash hands or change clothes before interacting with the child? ☐ Y ☐ N

41.2.e. (any details) _____

42.2. Does the child smoke in the second household? ☐ Y ☐ N

42.2.a. If yes, how much does he/she smoke and how often? _____

43.2 Any other drug use in the second household (i.e. illicit drugs)? ☐ Y ☐ N

43.2.a. If yes, who is using these drugs? _____

43.2.b. If yes, how much is being used and how often? _____

44.2. Do you have pets in the second home? ☐ Y ☐ N

44.2.a. What kind(s) of pet(s) _____

44.2.b. Are the pet(s) indoors or outdoors, or both? ☐ Indoor ☐ Outdoor ☐ Both

School Environment

46. Approximate age of the school building? _____

47. Describe the location of the school ☐ Urban ☐ Suburban ☐ Rural

48. What is the most usual mode of transportation your child uses to get to school? ☐ Walk ☐ Bicycle ☐ Skateboard ☐ Rollerblade ☐ Car ☐ City Bus ☐ School Bus ☐ Taxi ☐ Train

49. Is this school within 3 blocks (~300m) of a major road with at least single lane traffic two ways, that is fairly continuous throughout the day? ☐ Y ☐ N

50. Is this school within 3 blocks (~300m) of heavy traffic, including a stop light, or idling vehicles or school buses? ☐ Y ☐ N

50.a. (If yes, check all that apply): The school is near: ☐ Stop light ☐ 4-way stop ☐ Idling vehicles ☐ Idling school buses

51. Are there farms, parks, golf courses or school yards within 3 blocks (~300m) of the building? ☐ Y ☐ N

51.a. If yes, check all that apply ☐ Farms ☐ Parks ☐ Golf courses ☐ School yards

52. Are there industrial facilities, power plants etc., that are within 5 kilometers of the school? ☐ Y ☐ N ☐ I don't know

53. Any pesticides used inside, outside, or in the yard of school building? ☐ Y ☐ N ☐ I don't know

54. Are there carpets in the classroom? ☐ Y ☐ N

55. Are classrooms in a portable? ☐ Y ☐ N

56. Do you know of any renovation projects of the school building including demolitions, removals, repairs, or replacements? ☐ Y ☐ N

56.a. If yes, check all that apply ☐ Demolitions ☐ Removals ☐ Repairs ☐ Replacements

57. Do you know of any noticeable: peeling paint/water damage/mold that has occurred in the school building/portable? ☐ Y ☐ N

57.a. (If yes, check all that apply) ☐ Peeling paint ☐ Water damage ☐ Mold

58. Do you smell a musty or moldy odor in the school building/portable? ☐ Y ☐ N

59. Has your child complained about any smells from his/her surroundings in school? ☐ Y ☐ N

59.a. (any details) _____

60. Are there others (e.g. students, teachers, or parents) that have complained about smells from their surroundings in school? ☐ Y ☐ N

60.a. (any details) _____

61. Are there pets in school? ☐ Y ☐ N

61.a. (any details) _____

62. How is the building or portable heated? _____

63. Are the original symptoms better, worse, or the same when your child is at school? ☐ Better ☐ Worse ☐ Same

63.a. (any details) _____

Daycare/Day Home Environment

64. Does your child attend: ☐ Daycare ☐ Day home ☐ Other ☐ None of the above

64.a. If other, please specify _____

65. How many hours per week does your child attend? _____

66. How many children attend? _____

67. Approximate age of the care building? _____

68. Describe the location of the building ☐ Urban ☐ Suburban ☐ Rural

68.a. (any details) _____

69. Is the care building within 3 blocks (~300m) of a major road with at least single lane traffic two ways, that is fairly continuous throughout the day? ☐ Y ☐ N

70. Is there heavy traffic within 3 blocks(~300m) of the care building, including a stop light, or idling vehicles? ☐ Y ☐ N

71. Are there industrial facilities, power plants etc., that are within 5 kilometers of the care building? ☐ Y ☐ N ☐ I don't know

72. Are there farms, parks, golf courses or school yards within 3 blocks (~300m) of the building? ☐ Y ☐ N ☐ I don't know

72.a. If yes, check all that apply ☐ Farms ☐ Parks ☐ Golf courses ☐ School yards

73. Any pesticides used inside or in yard of care building? ☐ Y ☐ N ☐ I don't know

74. Do you know of any renovation projects of the care building including demolitions, removals, repairs, or replacements? ☐ Y ☐ N

74.a. If yes, check all that apply ☐ Renovations ☐ New carpets ☐ Paint ☐ Floor coverings ☐ Floor finishings

75. Do you know of any noticeable: peeling paint/water damage/mold that has occurred in the care building/home? ☐ Y ☐ N

75.a. If yes, check all that apply ☐ Peeling paint ☐ Water damage ☐ Mold

76. Do you smell a musty or moldy odor in the care building/home? ☐ Y ☐ N

77. Do you think there are any smells that bother your child from his/her surroundings in the care building/home? ☐ Y ☐ N

77.a. (any details) _____

78. Do any of the caregivers smoke? ☐ Y ☐ N ☐ I don't know

78.a. If yes, check all that apply ☐ Indoor ☐ Outdoor ☐ I don't know

79. Are there pets in the daycare/home ☐ Y ☐ N

79.a. What kind(s) of pet(s)? _____

Lifestyle

80. What is mother's current occupation? _____

81. What is mother's age? _____

82. What is father's current occupation? _____

83. What is father's age _____

84. What other jobs did either of them hold in the past (if any)? _____

84.a. (any details) _____

85. What level of education has the mother received?
- ☐ High school diploma or equivalent
- ☐ Registered apprenticeship or other trades certificate or diploma
- ☐ College, CEGEP, or other non-university diploma
- ☐ University certificate, diploma, or degree
- ☐ I don't know

86. What level of education has the father received?
- ☐ High school diploma or equivalent
- ☐ Registered apprenticeship or other trades certificate or diploma
- ☐ College, CEGEP, or other non-university diploma
- ☐ University certificate, diploma, or degree
- ☐ I don't know

87. Do you currently live in a single parent family household? ☐ Y ☐ N

88. Have there been any issues causing ongoing or short term stress/grief? ☐ Y ☐ N

88.a. If so, how long? (please specify years or months) _____

88.b. Please describe the cause of stress/grief for your family _____

89. About how much time daily does your child spend outside, if any? _____

89.a. Where outside is most of the time spent? Please check all that apply: ☐ Yard ☐ Playground ☐ Park ☐ Organized sports

90. What hobbies or sports are the family members involved in, if any? _____

91. Do you use hot tubs/swimming pools? ☐ Y ☐ N

91.a. If yes, check all that apply ☐ Hot tubs ☐ Swimming pools

92. Approximately how many hours/day in total does your child spend watching TV, playing video games, or on the computer? _____

93. Does your child have a cell phone? ☐ Y ☐ N

93.a. If yes, please check all that apply. Is the phone used more:
- ☐ For talking ☐ For texting
- ☐ With a blue tooth device
- ☐ With a head set ☐ With a speaker

Prenatal Exposures

94. How many weeks did your pregnancy last? _____

95. Birth Weight _____

96. Were there any problems with the pregnancy? _____

97. Mother's occupation(s) during and prior to pregnancy _____

97.a. (any details) _____

98. Father's occupation(s) during and prior to the mother's pregnancy _____

98.a. (any details) _____

99. Approximate age of your home during pregnancy? _____

100. During pregnancy, was your home within 3 blocks (~300m) of a major road with at least single lane traffic two ways, that is fairly continuous throughout the day? ☐ Y ☐ N

101. During pregnancy, was there heavy traffic within 3 blocks (~300m) of your home, including a stop light, or idling vehicles? ☐ Y ☐ N

102. Were there industrial facilities, power plants etc., within 5 kilometers of your home during pregnancy? ☐ Y ☐ N ☐ I don't know

103. Were there nearby farms, parks, golf courses, or school yards within 3 blocks (~300m) of your home? ☐ Y ☐ N ☐ I don't know

103.a. If yes, check all that apply ☐ Farms ☐ Parks ☐ Golf courses ☐ School yards

104. Any pesticides used in home/yard? ☐ Y ☐ N

105. Have you done any renovation projects including demolitions, removals, repairs, or replacements, during pregnancy? ☐ Y ☐ N

105.a. If yes, check all that apply ☐ Demolitions ☐ Removals ☐ Repairs ☐ Replacements

106. Did you know of any noticeable: peeling paint/water damage/mould that had occurred in your home during pregnancy? ☐ Y ☐ N

106.a. If yes, check all that apply ☐ Peeling paint ☐ Water damage ☐ Mould

107. Did you smell a musty or moldy odor in your home during pregnancy? ☐ Y ☐ N

108. Did the mother smoke during her pregnancy? ☐ Y ☐ N

109. Did the father smoke during the mother's pregnancy? ☐ Y ☐ N

109.a. If yes, did he smoke inside, outside, or in the car? ☐ Inside ☐ Outside ☐ In the car

109.b. (any details) _____

110. Were you exposed to cigarette smoke from anywhere else while you were pregnant? _____

111. Did the mother use any prescription or over the counter medications? ☐ Y ☐ N

111.a. If yes, please specify _____

111.b. If child was breastfed, was this continued during breastfeeding? ☐ Y ☐ N ☐ Not breastfed

112. Did the mother take any complementary or alternative therapies? (i.e vitamins, minerals, herbs, homeopathic remedies etc.) ☐ Y ☐ N

112.a. If yes, please specify: _____

112.b. If child was breastfed, was this continued during breastfeeding? ☐ Y ☐ N ☐ Not breastfed

113. Any other drug use (of prescription or illicit drugs) during and/or prior to pregnancy? ☐ Y ☐ N

113.a. (any details) _____

113.b. If child was breastfed, was this continued during breastfeeding? ☐ Y ☐ N ☐ Not breastfed

114. Any alcohol during pregnancy? ☐ Y ☐ N

114.a. If yes, how frequent and how much? _____

115. Hobbies or sports during pregnancy? _____

116. Any seafood/fish/sea mammals meals during and/or prior to pregnancy?
☐ Prior to pregnancy
☐ During pregnancy
☐ Both
☐ None at all

116.a. (any details) e.g. Type of sea food, amount, and frequency before or during pregnancy _____

Infancy Diet

117. Was your baby fed by breast, bottle or by both? ☐ Breast fed ☐ Bottle ☐ Both

117.a. If breast fed, how long was your child breast fed? (Please specify years or month) _____

118. Did you use a formula? ☐ Y ☐ N

118.a. If yes, please specify what kind of formula was used (e.g. soy milk, cow's milk, other) _____

119. Did/does your child use a soother? ☐ Y ☐ N

120. At what age did your child start eating solid foods, if any? _____

121. Does your child eat all foods? ☐ Y ☐ N

121.a. If no, are there any restrictions? _____

122. Does your child ingest any non-food items (e.g. dirt, clay, plastics, metals)? _____

123. How many cups of milk does your child drink per day? _____

124. Fast food meals per month? _____

125. Type of seafood/fish/sea mammals meals, amount, and how often, if any? _____

126. Does your child eat fruits and vegetables? ☐ Y ☐ N

126.a. About how many servings per day? _____

126.b. Are the fruits and/or vegetables peeled? ☐ Y ☐ N

127. Does your child regularly consume organic foods? ☐ Y ☐ N

127.a. (any details) e.g. percent overall diet that is organic _____

Additional Environmental Factors Affecting Respiratory Symptoms

128. Are your furnace and ducts well maintained? ☐ Y ☐ N ☐ I don't know

129. Do you have an air conditioner? ☐ Y ☐ N

129.a. If yes, what kind of air conditioner (e.g. window unit or central unit)? _____

129.b. Is your air conditioner well-maintained? _____

130. Do you use air purifiers (air cleaners)? ☐ Y ☐ N

130.a. If yes, what kind of air purifier? (e.g. window unit or central unit) _____

130.b. Is your air-purifier well-maintained? _____

131. Does your child sleep with stuffed animals? ☐ Y ☐ N

132. Does he/she sleep with feathers or down pillows or comforters? ☐ Y ☐ N

133. How often do you need to vacuum, mop, or dust your home? _____

133.a. (any details)? e.g. What kind of vacuum cleaner? _____

134. How often is the bedding washed per month _____

135. Any bedwetting? ☐ Y ☐ N

136. Is there carpeting in the child's room? ☐ Y ☐ N

137. Does the child have clutter in their room? ☐ Y ☐ N

138. Is your child exposed to perfumes, scented products, or harsh cleaners? ☐ Y ☐ N

138.a. If yes, check all that apply ☐ Perfumes ☐ Scented products ☐ Harsh cleaners

138.b. If yes, is your child bothered by these scented products? ☐ Y ☐ N

138.c. In which way(s)? _____

139. Are there any indications of insect or mice pests in your home? ☐ Y ☐ N ☐ I don't know

139.a. If yes, check all that apply ☐ Insects ☐ Mice

139.b. Do you use insecticides or rodenticides? _____

140. Is your child exposed to smoke from any wood? (i.e. forest fires, camp fires etc.) ☐ Y ☐ N

140.a. If yes, what type of wood and when? _____

141. Does your child experience seasonal symptoms? (i.e. cough, or runny nose)? ☐ Y ☐ N

141.a. If yes, please specify _____

142. Do you know what the Air Quality Health Index is? ☐ Y ☐ N

142.a. If yes, do you monitor the Air Quality Health Index? ☐ Y ☐ N

142.b. If yes, what do you do? (e.g. limit your child's activities...) _____

143. Is there anything you feel that might make your child's respiratory symptoms worse? _____

Additional Environmental Factors Affecting Neurological Symptoms

144. Does your child tend to put everything/anything in his/her mouth? ☐ Y ☐ N

144.a. If yes, how often? ☐ Occasionally ☐ Frequently ☐ All of the time

145. Is there any old chipped flaking paint, for example, around window sills, railings, doors, porches, outdoor walls, or anywhere in the child's environment? ☐ Y ☐ N ☐ I don't know

146. Are you aware of any lead water pipes in your home, school or daycare? ☐ Y ☐ N ☐ I don't know

147. In pregnancy, did your home or workplace have lead water pipes? ☐ Y ☐ N ☐ I don't know

148. Does anyone regularly eat wild meat shot with lead bullets/an ethnic diet with imported spices from Asia/candy from Mexico? ☐ Y ☐ N

148.a. If yes, check all that apply ☐ Wild meat ☐ Ethnic diet with imported spices ☐ Candy from Mexico

148.b. During pregnancy? ☐ Y ☐ N

149. Does anyone use: ☐ Ethnic remedies ☐ Herbal remedies ☐ Make-up (e.g. kohl) ☐ Skin ointments ☐ Products for ceremonial purposes ☐ No one uses the above

149.a. If any of the above are used, please specify who uses them _____

149.b. During pregnancy? ☐ Y ☐ N

149.c. (any details) _____

150. Do you cook, store or serve food in painted ceramic cookware or pewter? ☐ Y ☐ N

151. Does your child own inexpensive metal jewelry? ☐ Y ☐ N

151.a. If yes, do you ever see them putting it in their mouth? ☐ Y ☐ N ☐ I don't know

152. Are you aware of any lead contained items in your home such as candles, or mini blinds? ☐ Y ☐ N

152.a. If yes, please specify _____

153. Does the child have access to fishing tackle? ☐ Y ☐ N ☐ I don't know

154. Does your child have access to battery operated toys, watches, flashlights, glass thermometers, compact fluorescent lights? ☐ Y ☐ N ☐ I don't know

154.a. If yes, please specify _____

154.b. Do you ever see them put it in their mouth? ☐ Y ☐ N

155. Does your child play with imported toys (i.e brightly painted)? ☐ Y ☐ N ☐ I don't know

155.a. If yes, which ones? _____

155.b. If yes, do you ever see them putting it in their mouth ☐ Y ☐ N

156. Do you have old painted furniture? ☐ Y ☐ N

157. Has your child regularly left teeth marks on the furniture ☐ Y ☐ N ☐ I don't know

158. Have the mother, or father, or any household members ever worked in battery manufacturing/recycling, radiator repairs, lead smelting, brass and bronze foundry, demolitions/renovations of old property, firing range or pottery glazing? ☐ Y ☐ N ☐ I don't know

158.a. If yes, please specify _____

159. Any history of metal intoxication in child's mother prior to pregnancy ☐ Y ☐ N ☐ I don't know

159.a. (any details) _____

160. Did the mother ever have dental work done on any mercury amalgams during pregnancy? ☐ Y ☐ N ☐ I don't know

161. Has the mother or the child ever lived in an area where metal contamination was an issue (i.e. mines, foundries, tail dump sites, leaded gasoline, etc.)? ☐ Y ☐ N ☐ I don't know

161.a. (any details) _____

Appendix H

Ethics Forms

Validation of the Pediatric Environmental Health History (PEHH) Questionnaire

INFORMATION LETTER FOR PARENTS

Dear parent / guardian,

I am _____, a research assistant working for the Department of Pediatrics, University of Alberta, under the direction of Dr. Alvaro Osornio Vargas. We are doing research on a questionnaire that is used by doctors in their clinic to explore the environment's role in children's conditions.

If you have questions later, you can address them to the study doctor, the staff or me. This information sheet gives detailed information about this study, so you can make a decision about participating. When you understand the study and decide to participate, you will be asked to sign a consent form.

Purpose

Research these days is showing that the environment plays a large role in different children's conditions. Although this seems to be the case, many questions still have to be answered; especially questions related to the clinical tools that are used by doctors to help them deal with different environmental issues. Further research is needed for us to learn if these questionnaires are giving the doctors correct information about their patients. Because of this, the purpose of our study is to see if the **P**ediatric **E**nvironmental **H**ealth **H**istory (**PEHH**) questionnaire is a correct tool for identifying environmental exposures. Doctors have used this questionnaire in their clinics for many years, but we are unsure if it is accurate and useful to them.

Why are you being asked to be part of this study?

We are asking you to be in this study if you have not already completed the PEHH questionnaire. We want to learn more about the accuracy of this questionnaire, and plan on studying the responses from you and many other mothers. There will be about 100 other participants in this study.

The first step in this study is to see if the questionnaire is accurate. Once we have shown that this questionnaire is accurate and useful, doctors can ask their patients questions that are related to specific conditions in the future. They can then educate mothers such as yourself as to why your child has a certain condition. Finally, they would be able to give better healthcare to children and their families.

Project Title: Validation of a Clinical Questionnaire Specifically Designed to Identify Environmental Risk Factors

Study Director: Dr. Alvaro R. Osornio-Vargas
Research Assistants: Dr. Irena Buka and Priya Jaggi (MSc Student)

Description of the research study:

Our Children's Environmental Health (CEH) team wishes to see if the PEHH questionnaire is a correct tool in giving doctors environmental health information. Once you give your consent to participate in the study, the research assistant will apply this questionnaire to you over the telephone. This telephone

interview **will take about 20-30 minutes of your time.** You will be asked questions about your and your child's environment, and your responses will be recorded. These responses will be kept in a secure computer with a password that only the research assistant and principal investigator can look at. After we get all of the responses from all of our participants, they will be mathematically analyzed. This analysis will help us to change the questions and narrow the questionnaire down. These changes will allow doctors to administer the questionnaire more efficiently in the future and ask questions that are only relevant to specific conditions. The new version of the questionnaire will also give clinicians useful information. They will use the questionnaire to *firstly* identify exposures. *Secondly*, they can educate mothers as to why their child may have a certain condition. *Thirdly*, using this collected information, they will be able to apply reductive or preventative measures for future exposures.

Being parents, we think that you could better answer environmental health history questions that are related to you and your child. The PEHH questionnaire is made up of ten main sections. We will ask you questions about:

1) Demographics
2) General environment
3) General environment of second household (if applicable)
4) School environment
5) Daycare/ Day Home environment
6) Lifestyle
7) Infancy/ Childhood
8) Prenatal Exposures
9) Respiratory symptoms
10) Neurological symptoms

Do you have to be in the study?

It is up to you whether you would like to take part in this study. No one will be upset if you decide you do not want to participate, or if you want to stop after you have already started. If you don't want to take part in the study at all, or want to leave, you just have to tell us. Once you have completed the questionnaire, you can even ask to have your data removed if you decide that you do not want us to use it. You have about six months to do this, which is the time it will take for us to finish all of our interviews.

Who will see the information collected about you?

No personal information will be collected except your telephone number on the consent form so that the research assistant can call you. However, any research data that is collected during this study will only identify you and your child by a coded number, not your telephone number. Personal health records relating to this study will be kept confidential. The identifying information such as your charts will be kept in the research clinic. Only clinicians or nurses at the environmental health clinic will have access to it. The data collected by the research assistant will be mixed with that of other children, and will remain completely confidential. This data will be stored in the Children's Environmental Health clinic in a secure, locked location for a minimum of **5 years.** This study has been reviewed by the University of Alberta Health Research Ethics Board which is responsible for making sure that research with patients is appropriate and that the patient's rights and welfare are protected.

For this study, the study group **does not** need to access your child's personal health records for past medical history and test results. The environmental health information collected, as part of this study will be kept confidential unless release is required by law, and will be used only for the purpose of the research study. By signing the consent form, you give permission to the CEH team to access the questionnaire responses. This information is under the custody of our health care professionals as deemed necessary for the conduct of the research.

What do you get for being in the study?

There is **no immediate benefit** to you or your child by taking part in this study. However, you will have a completed PEHH questionnaire in your record and can come to the clinic to receive consultation if you wish to do so. The doctor also has a completed questionnaire that can help them answer any of your concerns.

Will any part of the study hurt?

Taking part in this study will not affect any other therapies and medicines your child is receiving, but some questions may cause some anxiety. If this happens, you can visit Dr. Irena Buka (Head of the Children's Environmental Health Research), and Dr. Alvaro Osornio-Vargas (Principal Investigator) to help answer any concerns. We will make every effort to make sure that your concerns are addressed properly. You can also share your views and thoughts with other families that are dealing with similar problems, if you wish to do so.

What if you have any questions?

A Research Ethics Board at the University of Alberta has reviewed the plan for this study for its adherence to ethical guidelines. For questions regarding participant rights and ethical conduct of research, contact the Research Ethics Office at (780) 492-2615.

If you have any questions or concerns about this study and/or your participation, you may contact:

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PARENT CONSENT FORM

Title of Project: **Validation of a Clinical Questionnaire Specifically Designed For Identifying Environmental Risk Factors**

Study Director:

Dr. Alvaro R. Osornio-Vargas, Department of Paediatrics, Faculty of Medicine and Dentistry, University of Alberta. Phone: (780) 407-7092.

Research Assistants:

Dr. Irena Buka, Children's Environmental Health Clinic, Child Health Clinic at the Misericordia Hospital, 2nd Floor, Mother Rosalie Health Services Clinic, 16930-87 Ave, Edmonton, AB T5R 4H5. Phone: (780)-735-2443.

Priya K. Jaggi, BSc, MSc Candidate. Department of Paediatrics, Faculty of Medicine and Dentistry. University of Alberta. Phone: (780)-965-8771.

Part 2 (to be completed by the research subject):

	Yes	No
Do you understand that you have been asked to participate in a research study?	☐	☐
Have you read and received a copy of the attached Information Sheet?	☐	☐
Do you understand that you will be required to answer the questionnaire through a telephone?	☐	☐
Do you understand the benefits and risks involved in taking part in this research study?	☐	☐
Have you had an opportunity to ask questions and discuss this study?	☐	☐
Do you understand that you are free to withdraw from the study at any time, without having to give a reason and without affecting your child's future medical care?	☐	☐
Do you understand who will have access to your child's records, including personally identifiable health information?	☐	☐

Who explained this study to you? _____

I agree to take part in this study: YES ☐ NO ☐ Phone Number _____

Signature of Parent or Guardian _____ Date _____

(Printed Name) _____ Your relation to the child: _____

I believe that the person signing this form understands what is involved in the study and voluntarily agrees to participate.

Signature of Investigator or Designee _____ Date _____

THE INFORMATION SHEET MUST BE ATTACHED TO THIS CONSENT FORM AND A COPY GIVEN TO THE RESEARCH SUBJECT

Lessons Learned and Concluding Remarks

Throughout this study, I was faced with numerous challenges. However, with constructive feedback from my committee and endless support from my preceptor, I was motivated to take on these challenges and find effective ways to overcome different obstacles.

Prior to starting my research, I sought relevant courses to provide me with the necessary background and set the context for my study. Five courses that intrigued me were Principles of Toxicology, Environmental Contaminant Assessment, Biostatistics I, PAED 500 (seminar course), and finally Methods in Assessment of Health Related Quality of Life.

Briefly, "Principles of Toxicology" was particularly useful and interesting as it allowed me to gain insight into the importance of toxicants and their associations to different health outcomes. I learned that quantitatively characterizing body burden (e.g. human biomonitoring) of different toxicants is important. However, this quantification is most informative when complementary information provided by questionnaires is also available (e.g. potential sources of exposures), hence the direct relevance of my research study. "Environmental Contaminant Assessment" taught me about different modes of distribution and quantification of environmental chemicals throughout the environment. "Biostatistics I" gave me the statistical background necessary for my data analysis. Through "PAED 500" I learned how to organize my own ideas in the form of a research proposal and how to address different biases and limitations within my own research study. Lastly, I found "Methods in Assessment of Health Related Quality of Life" to be especially useful since it was directly relevant to my research. I learned about the fundamentals in validating measurement instruments (e.g. questionnaires), what it is meant for a measurement instrument to be valid and reliable, and the different psychometric properties that are important to consider with regards to the measurement instrument.

During the initial stages of my research study, I encountered challenges with my data analysis. An example is the analysis of expert consensus, in which we initially decided to focus on the kappa statistic. The kappa statistic is used to assess inter-rater agreement for categorical data, which I initially though would be adequate provided the nature of our data. Overtime, I learned that reliability is not a property of the questionnaire itself, but of the data you collect with the instrument. Therefore, rather than using this to assess the responses retrieved by our experts, we focused on determining expert consensus using Percent Agreement. I have recognized that devising appropriate methods for data analysis *a priori* is very important and can substantially reduce the burden of analyzing the data when it becomes available.

Each stage of my research study has taught me different lessons and I could provide endless examples. This entire experience was a valuable lesson on it's own. Most importantly, the fundamental skills that I gained from my overall experience – starting from my experience as a summer student, facilitated my growth as an individual. These skills include learning how to think transparently, write effectively (e.g. applying for grants and studentships), articulate my findings through presentations, and working amongst an interdisciplinary team that is motivated to achieve collective goals.

I am truly thankful for having a wonderful preceptor who gives me constant encouragement and motivation, provides constructive feedback, and is always willing to spend time helping me overcome frustrations. This experience along with that as a summer student has further intrigued me in pursuing future research focusing on environmental associations with neurodevelopmental conditions (e.g. autism). Neurodevelopmental research has been my initial passion and this current study has given clear opportunity for me to pursue new challenges.