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Babies' Exposure to Phthalates in the Home: Developing a Profile of Allergy and Asthma

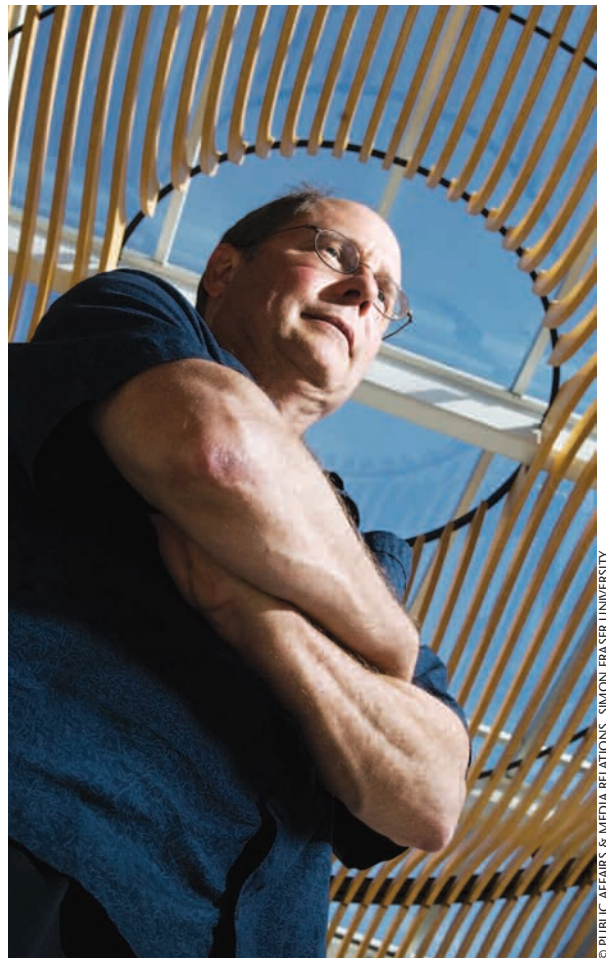
How can you detect the presence of industrial chemicals called 'phthalates' in babies without taking a urine sample and ordering an expensive laboratory analysis? A multi-disciplinary team of researchers led by Dr. Tim Takaro, an Associate Professor at Simon Fraser University, discovered that you can predict part of the body burden of phthalates in a baby's urine by simply asking his or her parent's questions about the baby products that they use and the toys the baby plays with.

This research is an example of how collaborations across Canadian universities and partnerships between academia and industry breed success — which is why AllerGen NCE actively promotes broad professional relationships through networking and funding. On this multi-disciplinary team are researchers from Simon Fraser University (Drs Takaro and Ryan Allen); University of British Columbia (Drs Michael Brauer and Stuart Turvey); University of Toronto (Dr. James Scott); and Environment Canada (Dr. Jeff Brook). This team of environmental scientists and clinician-scientists in paediatrics, allergy/immunology and respiratory medicine, also partnered with the Canadian Housing and Mortgage Corporation on this project.

This study found a simple way of assessing babies' exposure to phthalates. The next step is the most wide-ranging investigation ever done in Canada on babies and the development of allergy and asthma, referred to as the Canadian Healthy Infant Longitudinal Development (CHILD) Study. This research team and other AllerGen-affiliated researchers are concerned with the larger question of what causes childhood allergy and asthma — chronic diseases that are rising in Canada at alarming rates. The widespread presence of phthalates in Canadian homes is just one factor being examined by the team.

What Are Phthalates?

Phthalates are industrial chemicals that are used to make an astounding number and variety of products found in the average Canadian home, including: personal care products for adults



Dr. Tim Takaro, Associate Professor, Simon Fraser University.

and kids; cosmetics; perfumes; cleaning and laundry detergents; lubricants; packaging; food; food containers and wrappers; drugs; fabrics; shower curtains; vinyl flooring; electronic equipment; paints; building materials; baby and toddler pacifiers; plastic feeding bottles; and children's toys. This is by no means a complete list.

Phthalates crept into widespread use over the last several decades because of their ability to increase a product's flexibility, transparency, durability and longevity. The problem is that phthalates do not chemically bind to the other materials in a product, so they continually leach out into the surrounding environment — like your home or baby bottle. In the United States, the *National Health and Nutrition Examination Survey* (NHANES) found that over 95% of the entire population has phthalate residues in their urine — which means that these chemicals are getting into our bodies — through our noses, skin and mouths.

Success Stories: *Innovation from cell to society*

Significant evidence exists suggesting that phthalates have a negative impact on human health. Scientists also wonder if phthalates have the ability to exacerbate allergic reactions to an allergen — a possible clue as to why allergy rates have exploded in industrialized nations around the world.

Looking for New, Inexpensive Ways of Assessing Phthalates Exposure

Canadian researchers like Dr. Takaro are trying to understand the causes of childhood asthma — a chronic and, therefore, lifelong disease in which the airways of the lungs are often inflamed, even when the patient is not experiencing breathing difficulties. According to the Asthma Society of Canada, currently one in eight Canadian children suffers from this disease and it is the leading reason for Canadian children missing school or being admitted to hospital.

Dr. Takaro and his colleagues are working towards developing a profile of children with allergy and asthma in Canada



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within the CHILD Study. One of the research questions that this study asks is “what is the possible role phthalates play in allergy and asthma?” The first step towards answering this question was to find a new, relatively quick and inexpensive way of assessing babies’ exposure to phthalates. Exposure to phthalates is usually ascertained by analyzing a urine sample. However, it is quite expensive to undertake this laboratory analysis and it can also be difficult to collect a urine sample from very small children. Given the size of the CHILD Study, which is tracking the health of 5,000 Canadian babies, practical considerations such as cost and ease of assessing phthalate exposures become important.

As a result, Dr. Takaro and his team participated in a ‘mini-study’ in Vancouver, involving 94 babies, all around three

months of age. At this young age, children do not have asthma — although approximately 12% of Canadian children will eventually develop this disease.

The team collected a lot of information about the babies (beyond phthalate exposure) using four methods: 1) a questionnaire about the home environment and products found in the home, which was completed by parents; 2) home inspections by trained assessors looking for potential asthma triggers; 3) collection and analysis of dust samples from the floor; and 4) collection and analysis of urine samples for levels of phthalates.

Three month old infants from Vancouver had a range of detectable phthalates in their urine at levels comparable to recently surveyed U.S. children. For some phthalates, questionnaires could predict risk of phthalates in a baby’s urine by know-

ing what products went directly on his or her skin (such as lotion and shampoo) and directly into the baby's mouth (such as pacifiers, baby bottles and toys made of soft plastic). Further analyses are ongoing, but it does appear that questionnaires about baby products in the home, along with home inspections by trained assessors, are a cheap and effective alternative to urine tests for assessing phthalate exposures.

The CHILD Study — On the 'Cutting Edge' of Canadian Research

The CHILD Study is a pioneering study of how genetic susceptibility and environmental exposures combine (gene-environment interactions) in the development of childhood asthma. "This collaborative Canadian initiative has united experts from AllerGen NCE's research program with public and private sector organizations," states AllerGen NCE CEO and Scientific Director, Dr. Judah Denburg. "It is a Canadian first in allergic disease research."

Takaro's 'mini-study' of 94 babies living in Vancouver proved to be a useful 'pilot' study for the CHILD Study — a pilot study is a small scale preliminary study conducted before the main research is undertaken in order to improve the final research design. Dr. Takaro and his team were successful in finding a relatively inexpensive and reliable method for assessing phthalate exposures in babies in the form of questionnaires and home visits. They developed several research guidelines for exposure assessment in the CHILD Study. They trained a group of people and put together a manual in the methods for doing effective home assessments and for collecting dust and urine samples. They also collected data for future analysis on other indoor factors that could contribute to allergy and asthma — like dust mites, cockroaches, rodent droppings and traffic pollution entering the home. Allergy and asthma experts realize that in analyzing the health effects of indoor contaminants, they cannot focus on just one thing (like phthalates) because contaminants likely interact with one another.

The CHILD Study also collects data on other potentially important factors in the development of allergy and asthma besides indoor and outdoor contaminants, such as: nutritional history, infectious exposures, psycho-social stress, immune system function and genetics.

The challenge for researchers is to develop a profile of allergy and asthma that can successfully understand and

predict which children will develop asthma and which will not and then to design and deliver public health strategies and policies to prevent asthma. Dr. Takaro anticipates that, "In 7 years from now, the CHILD Study will pay off. We will be able to say that of the 5,000 children studied who developed asthma, this is their profile: they have these kinds of homes; they have these sorts of exposures; they live this far from a freeway — they have these sorts of behaviors in their childhood that increase their phthalates exposure — they have this interaction between diesel and dust mites or mould and phthalates — and people with gene X, Y and Z, are much more susceptible to these exposures than people who have genes A, B and C."

Dr. Takaro describes the CHILD Study as "cutting-edge" research because of the techniques being used, because it considers multiple exposures such as phthalates and traffic pollution, which hasn't been done before, and because it involves researchers with different and varied areas of expertise working together towards a common goal. Dr. Takaro credits AllerGen NCE with bringing multi-disciplinary teams together through its networking efforts, and through its conferences and annual meetings where researchers can present and discuss their work. He adds that, "Part of the cohesiveness of this group is the presence of funding (by AllerGen NCE) that places a high value on interdisciplinary work. Not all funding does that."

Beyond collaborations across Canada, there may be future opportunities between the Canadian researchers working on the CHILD Study and international research teams studying birth cohorts. Dr. Takaro is excited about the future possibilities, "You need a body of work — more than one study — to support a new conclusion about gene-environment interactions, or about [the cause of a] disease... Every study that contributes to that increases the confidence that scientists have in the results."

If AllerGen NCE and CHILD Study researchers have their way, future generations of Canadian children will be spared the burdens of living with allergies and asthma. Dr. Takaro states that, "There is evidence that if you intervene early, you can prevent asthma from occurring. Asthma is rarely diagnosed before the age of five." Profound changes are needed in how we diagnose, treat and manage allergy and asthma, and Takaro's science is helping to guide us in the right direction. 