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**Chronic Health Disparities among Refugee and Immigrant  
 Children in Canada**

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**Title: Chronic Health Disparities among Refugee and Immigrant Children in Canada**

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**21 Abstract:**

22 There are knowledge gaps related to understanding the development of chronic disease risks in  
23 children, especially with regards to risk differentials experienced by immigrants and refugees.  
24 The Healthy Immigrant Children study employed a mixed-methods cross-sectional study design  
25 to characterize the health and nutritional status of 300 immigrant and refugee children aged 3-13  
26 who had been in Canada for less than five years. Quantitative data was collected regarding  
27 socio-economic status, food security, physical activity, diet, bone and body composition, and  
28 anthropometric measurements. Qualitative data was gathered through in-depth interviews with  
29 the parents of newcomer children regarding their experiences with accessing healthcare and their  
30 family lifestyle habits. Many newcomers spoke about their struggles to attain their desired  
31 standard of living. In regards to health outcomes, significantly more refugees (23%) had stunted  
32 growth compared to immigrants (5%). Older children, those with better educated parents, and  
33 those who consumed a poorer quality diet were at higher risk for being overweight/obese. Sixty  
34 percent of refugees and 42% of immigrants had high blood cholesterol. Significant health  
35 concerns for refugee children include stunting and high blood cholesterol levels, while emerging  
36 trends indicate older immigrant children from privileged backgrounds in low-income countries  
37 may be more at risk for overweight and obesity. A variety of pathways related to their families'  
38 conceptualization of life in Canada and social structures that limit progress to meeting their goals  
39 likely influences the development of health inequity among refugee and immigrant children.  
40 Public health initiatives should address health inequities among newcomer families.

**Key Words:** Children, Refugee, Immigrant, Nutrition, Chronic Disease, Health

**Introduction:**

The existence of a “healthy immigrant effect” in which foreign-born individuals arrive in Canada in better health than that of the Canadian-born, but experience health declines with increasing years in Canada has been noted by many researchers (Gushulak et al. 2011; Hyman 2004; MacDonald and Kennedy 2004). Adult newcomers aged fifteen years and older

experience significant health declines within as little as two to four years post arrival based on reports of self-assessed health status (Newbold 2009; Zhao et al. 2010). Compared to the Canadian-born, recent newcomers experience a lower incidence of chronic diseases, including heart disease, cancer and diabetes, along with a slow increase in the incidence of chronic diseases over twenty to twenty-five years until it converges with that of the Canadian-born (MacDonald and Kennedy 2004). In addition, Ng et al. (2011) observed that recent adult newcomers had significantly lower age-standardized mortality rates (ASMR) than the Canadian-born, and that newcomer ASMRs increased with time spent in Canada, but newcomer ASMRs remained significantly lower than those of the Canadian-born. However, this finding did not hold true for all newcomer subgroups in the study (Ng 2011). In addition, immigrants start out with a lower risk of atherosclerosis, a risk factor for cardiovascular disease, but this risk increases in direct relation to length of residency such that after twenty years immigrants are at increased risk of atherosclerosis in comparison to the Canadian-born (Lear et al. 2009). These cross-sectional studies indicate the existence of a health differential between recent adult newcomers and the Canadian population and a gradual convergence of newcomer health status towards the Canadian average.

However, there are deviations from the healthy immigrant effect as an analysis of 2007-2008 Canadian Community Health Survey (CCHS) data indicated that immigrants and the Canadian-born experience similar rates of high blood pressure and heart disease/stroke and immigrants are at increased risk (20%) for diabetes as compared to the Canadian-born (Betancourt and Roberts 2010). There also appears to be notable ethnic differences, as Creatore et al. (2010) have observed that newcomers from the Caribbean, Latin America, South Asia and sub-Saharan Africa have a two to three times higher risk for developing type II diabetes and tend

to develop type II diabetes between 20 and 40 years of age. However, those from Western Europe and North America tend to develop the disease between 35 and 49 years of age (Creatore et al. 2010). The above research highlights that some newcomer groups can experience rapid health declines in Canada.

Although the “healthy immigrant effect” exists overall, it does not manifest consistently across all groups of newcomers. Refugees commonly arrive in worse health than other types of newcomers, and they are at higher risk of transitioning to poor health (Beiser et al. 2002; Beiser 2006; Rousseau and Drapeau 2003; Wu et al. 2003). In the United States, about one-third of refugees report that they are in fair or poor health (Jasso et al. 2000). Refugees are at higher risk of mortality, infectious diseases, and mental health problems. In addition, Ng et al. (2005) have noted that recent non-European newcomers (< 10 years) have experienced significant deterioration in self-rated health and increased BMI over time in comparison to the Canadian-born; however, European newcomers did not. In a similar vein, McDonald and Kennedy (2004) observed more favourable health outcomes among pre-1980s newcomers, who were more commonly of European descent, as compared to more recent cohorts that included a higher proportion of individuals from Asia and Africa (Citizenship and Immigration Canada, 2015). These findings demonstrate that newcomers are not a homogenous group as diverse life experiences interact to influence observable health outcomes.

The healthy immigrant effect has been confirmed among adult newcomers, but there is only a nascent body of evidence related to mortality risks, health status, and the healthy immigrant effect among children. Perreira and Ornelas (2011) have observed that newcomer children in the United States typically have lower mortality risks than children born to immigrant parents and children born to U.S.-born parents. In addition, Maximova et al. (2011) found that

first generation newcomer children experienced lower body mass index (BMI) increases annually as compared to second generation newcomer and Canadian-born children over a five year period. This emerging evidence indicates that the “healthy immigrant effect” may exist among newcomer children.

Prior to migration, children are situated within familial socioeconomic environments that can impact their future health through a number of avenues. Van Hook and Balistreri (2007) have reported that low-income newcomer children originating from less developed countries have lower BMIs and BMI growth rates, as compared to high-income children from the same countries or from more developed countries, which is consistent with observations in less developed countries where children in low-income families are at higher risk of malnutrition and stunting, while children with higher socioeconomic status are at risk for overweight and obesity in the same country (Perreira and Ornelas 2011). In addition, many children who immigrate to Canada originate from countries with a high incidence of stunting, including Pakistan (42%) and Myanmar (41%) (UNICEF 2009). Accordingly, pre-migration poverty is a risk factor for malnutrition and growth stunting during children’s key growth periods that may permanently limit their future growth and development, while children from high-income families may be at risk of overweight/obesity.

Studies highlight the vulnerability of refugee children as 80 to 90% of refugee children have been exposed to harsh conditions including long-term hunger and violence (Lustig et al. 2004). These hardships initiate a trajectory that puts refugee children at increased risk for malnutrition and chronic health problems after resettlement (Perreira and Ornelas 2011). Children from some areas may already have high cholesterol or type II diabetes, as has been observed among children in the middle-east (Mohsen et al. 2001; Moussa et al. 2008). Through

the migration process refugee children may have been exposed to extreme hardships that can have long-term impacts on their health.

Currently there is limited evidence regarding the development of chronic disease risks among newcomer children, especially with regards to differentiating the risks experienced by immigrants in comparison to refugees. The Healthy Immigrant Children (HIC) study was initiated in 2011 with the overarching goal of improving the nutrition and health status of newcomer children in Canada through expanding the body of research related to health status concerns among newcomer children, and health inequities between immigrant and refugee children. This paper presents data that characterizes the health status of immigrant and refugee<sup>1</sup> children aged 3 to 13 who have been in Canada for less than 5 years.

#### **Methods:**

This study employed a mixed method design using a combination of quantitative and qualitative methods in alignment with the critical realist methodological approach (Danermark et al. 2002) to yield complementary data and to allow for methodological triangulation to support a more complete description of the health status of newcomer children and the underlying mechanisms or pathways to health outcomes. According to Denzin and Lincoln (2000) the use of triangulation encourages an improved understanding of the relationships between and among variables, and enhanced data validity.

The study involved the collection of qualitative data through in-depth interviews with the parents of newcomer children regarding their family lifestyle habits and their experiences with accessing healthcare. The collection of quantitative data was accomplished through the administration of questionnaires concerning socio-economic status, food security, physical



activity, and diet to the parents and completion of physical exams on the children. Information gathered through the questionnaires and children's physical exams primarily informed the development of a comprehensive description of newcomer children's health status, while the in-depth interviews facilitated the identification of lifestyle trends and healthcare access issues that may impact health status. Qualitative interviews facilitated reaching deeper layers and complexities that the quantitative measurements alone would not permit.

### ***Participant Recruitment***

The HIC study involved a cross-sectional analysis of 300 immigrant and refugee children aged 3 to 13 years who had been living in Regina or Saskatoon, Saskatchewan, Canada for less than 5 years. Study participants were purposefully selected to reflect the current Saskatchewan newcomer population. Only healthy children, not currently being treated for malnutrition or other serious medical problems, were recruited.

Several newcomer settlement organizations, such as Open Door, assisted with participant recruitment by inviting parents to nominate their children to participate. Parents provided written consent to participate in the study, and written confirmation that their children assented to participation. The University of Saskatchewan Research Ethics Committee provided ethical approval. Interviews were conducted in English and interpreters were available as needed to assist parents and children.

### ***Quantitative Data Collection and Analysis***

The first phase of the study involved the collection of quantitative data through the administration of questionnaires concerning socio-economic status, food security, physical activity, and diet to the parents and completion of physical exams on the children.

Specific questionnaires utilized included: a modified version of the Canadian Community Health Survey (CCHS) 2008 socio-economic and demographic questionnaire, modified version of the United States Department of Agriculture (USDA) Household Food Security Questionnaire used in the CCHS, Statistics Canada's children's physical activity questionnaire, Vitamin D Food Frequency Questionnaire used in Pediatric Bone Mineral Accrual Study at University of Saskatchewan (Baxter-Jones et al., 2010) to explore usual intake of vitamin D rich foods, and serial 24 Hour Dietary Recalls. With the assistance of their parents, each child was asked to complete three 24-hour dietary recalls, which were completed at least ten days apart to allow for an assessment of participants' usual intakes (Gibson 2005). The three 24-hr dietary intakes were averaged to obtain each participant's usual intake. All three 24-hr recalls were administered in person by a research assistant. Although the option of completing the 2 follow up 24-hr recalls over the phone was explored, it was not used due to language barriers and difficulties with describing portion sizes. Diet information was entered into a diet analysis program *Food Processor Nutrition and Fitness Software version SQL 10* (Esha Research, Salem OR) to determine intake of food group portions and specific nutrients. Overall dietary adequacy was assessed using the Canadian version of the Healthy Eating Index (HEI) (Garriguet 2009).

All research assistants attended training sessions, which included orientation to all procedures. Training included practice with volunteers outside of the study, observation of previously trained research assistants gathering data from study participants, and administration of procedures under the observation of the researcher until mastery was achieved. Nutrition graduate and senior undergraduate students served as research assistants.

Anthropometric measurements included children's height, weight and waist circumference. A digital scale was used to measure each child's weight while s/he wore light

clothing without shoes. Weight was recorded in kilograms to the nearest gram. A second measurement was taken and if the 2 results were similar ( $SD=\pm 0.5$  kilograms), the average of those 2 numbers was calculated and recorded. If the variance between the 2 values exceeded 0.5 kilograms, a third measurement was taken and the average of the 2 closest numbers was calculated and recorded as the final weight.

A Stadiometer was used to measure each child's height without shoes. The child stood on the Stadiometer platform with her back to the scale and contact points (heels, buttocks, and shoulder blades) lightly contacting the scale. The headpiece was positioned so that it lightly touched the child's head. After taking a deep breath in and out, the child stepped off the platform and height was recorded in centimetres to the nearest millimetre. A second measurement was taken and if the 2 values were similar ( $SD=\pm 0.5$  centimeters), the average of the 2 numbers was calculated and recorded. If the variance between the 2 values exceeded 0.5 centimeters, a third measurement was taken and the average of the 2 closest numbers was calculated and recorded as the final height. While the participant was in the standing position, waist circumference was measured to the nearest millimetre using a flexible measuring tape around the waist at the high point of the iliac crest at minimal respiration (Li et al., 2006) with up to 3 measurements taken similar to the height measurement procedure.

Participants' blood pressure was measured up to three times in accordance with the National High Blood Pressure Education Program standards and guidelines (2004). A dual energy x-ray absorptiometry (DXA) machine, Hologic Inc, Discovery-Wi, Bedford, USA. Serial # 80964, was used to assess participants' body composition, bone mineral content and density of total body, hip, and lumbar spine. All DXA measurements were conducted by a trained radiology technologist.

Participant blood samples were obtained through a single finger prick to assess serum glucose, total cholesterol, and serum vitamin D. Serum glucose was measured on site during the first participant measurement session using an Accu-Chek® Aviva Nano glucometer (Roche Diagnostics, Mannheim, Germany).

After collecting the first drop of blood to check serum glucose, several blood drops were collected on blood filter cards to be sent to an external laboratory for nonfasting total cholesterol and serum vitamin D analysis in accordance with validated collection methods (Kapur et al., 2008). The cards were dried for 30 minutes and stored at -20° Celcius until they were sent for analysis. The cholesterol analysis involved a validated analysis (ZRT, 2018) based on the enzymatic hydrolysis and oxidation method originally developed by Allain et al. (1974).

Participants' serum vitamin D levels (total 25-hydroxyvitamin D) were assessed using Varian 1200L liquid chromatography-tandem mass spectrometry (Eyles et al., 2009).

Descriptive data is presented as means  $\pm$  standard deviation to compare refugee children to immigrant children. Prevalence of inadequacy of nutrient intake was determined using dietary reference intake approaches, and overall dietary adequacy was evaluated using Canadian Healthy Eating Index scores. Children's body composition DXA measurements were categorized according to American anthropometric standards (Laurson et al. 2011) and separately for those aged 8-13 years old because American DXA standards are available for this age group (Ogden et al. 2011). Waist circumference percentile data is presented using American standards for all participants aged five and older (Fernandez et al. 2004); while waist circumference data for children aged 11-13 years old is also presented using Canadian standards available for this age group (Katzmarzyk 2004).

Data was tested for normal distribution using Shapiro-Wilk test, and when found to be not normally distributed data was either transformed or subjected to equivalent non-parametric tests (Mann Whitney U-test). A 2-sided independent Student's t test was used to evaluate differences between refugees and immigrants. Multivariate linear and logistic regression models were used to investigate associations between health outcomes, dietary adequacy, physical activity level, socio-economic status, food security and other possible confounders. Statistical best fit model building involved univariate analysis to determine a subset of explanatory variables, subsequent multivariate analysis with the elimination of variables that did not contribute to the best fit, exploring interactions between variables, and checking for confounding variables. Statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS, IBM). Alpha was set at 0.05 for all tests.

### ***Qualitative Data Collection and Analysis***

The second phase of the study involved inviting a purposefully selected sample of the participants' parents to participate in in-depth interviews to better understand newcomer health care access issues and family lifestyle practices that may impact children's health status. A diverse selection of 19 refugee and immigrant parents of various ethnic and socio-economic backgrounds participated in in-depth individual or household interviews. Although the interviews were arranged with the parents, these interviews sometimes became family interviews as their children and other extended family members chose and consented to participate. The same questions were asked, with answers transcribed noting the speaker whenever possible, and the resulting data used in the analysis. The first section of the in-depth interviews focused on awareness of the Canadian healthcare system, and barriers and supports that may affect access to healthcare services, while the second section focused on family lifestyle practices, including

263 dietary changes, and barriers to children's participation in physical activities. The interview  
264 questions were modified from existing questionnaires whenever possible (Groleau and Kirmayer  
265 2004; Young et al. 1999; Weerasinghe and Mitchell 2007). Interviews used open-ended  
266 questions to facilitate the collection of rich, descriptive narratives (Morse and Field 1995) until  
267 further interviews did not yield significant information beyond that already collected, indicating  
268 saturation had been reached.

269 In addition, a purposefully selected sample of newcomer service providers, healthcare  
270 providers, and policy makers was invited to participate in in-depth interviews to understand their  
271 perspectives on newcomer health and healthcare access issues. A diverse sample of 24  
272 participants from a variety of organizations that interact with newcomers in a variety of settings  
273 and at different levels was selected to illuminate the diversity of perspectives. Consenting  
274 participants included 22 service providers from settlement agencies, community schools,  
275 English-as-a-Second-Language programs and healthcare organizations, as well as two policy and  
276 program consultants from government departments. Some organizations designated 2 or 3 of  
277 their staff to participate in interviews so they were interviewed as a small group using the same  
278 questions and transcribing answers with the speaker noted whenever possible. The interview  
279 questions built upon current understandings of health concerns among immigrants and refugees  
280 and factors that may be impacting healthcare system access, and were modified from existing  
281 questionnaires whenever possible (Young et al. 1999; De Jesus 2009; O'Mahony and Donnelly  
282 2007). Similar to newcomer's in-depth interviews, questions were open-ended, and interviews  
283 were conducted to the point of saturation.

284 Thematic content analysis was used to analyze in-depth interview data. Interviews were  
285 taped and transcribed verbatim following the sessions, and rechecked against the audiotapes a

second time. An inductive approach with open coding of early data was used to generate categories embedded in the data in alignment with grounded theory (Green and Thorogood 2007). Deviant cases were thoroughly reviewed to capture diverse experiences of the sample population. Early interviews were conducted concurrently with data analysis occurring in an iterative process so initial results could be used to open up additional lines of investigation and further fine tune participant questions and probing. This process supported the transformation of individual narratives into a critique of social processes and structures that organize lived experiences.

Salient data extracts corresponding to the research questions were identified in order to generate coding categories across the entire data set, which were then reviewed to identify main themes and collate relevant code categories among them. The identification of themes relied on both number of similarly coded data extracts, as well as divergent experiences of some importance in responding to the research questions. Themes were further refined by combining categories and organizing sub-themes under them. NVivo11 was used to facilitate qualitative data analysis.

The qualitative and quantitative data were explored to identify areas of convergence or triangulation (Ratcliff 1995). This combination provided a broader context to more fully explain the results and enhance validity. The in-depth interview data provided rich insight into lived individual experiences, as well as overcoming the possibility that quantitative data could lead to the development of unwarranted categories and priorities that lead research down a reductionist path (Young et al. 1999). Thus, the triangulation of quantitative and qualitative data supported the development of a robust data set based on lived experiences and descriptive quantitative data.

**Results:*****Quantitative Results***

The cross-sectional study included a total of 300 children aged 3-13 years. Thirty-seven participants did not complete all parts of the study due to withdrawing from the study or by becoming unreachable to the researcher. Primarily due to failure to attend all measurement sessions, some families did not complete the food security questionnaire or all three 24 hour recalls and some parents either did not know or chose not to report their income. In addition, some children experienced difficulties with providing blood samples and/or with lying still for DXA bone scans. As a result missing values included: income (10.0%), food security (5.7%), usual intake of food and nutrient values (3 - 24 hour recalls) (12.3%), measures derived from blood samples (8.0%) (glucose, cholesterol, serum vitamin D), and DXA measurements (7.3%) (bone mineral content and body fat). Analyses involving specific variables did not include cases with missing values.

***Demographics and Socio-economic Status (see Table 1)***

Study participants commonly originated from Asia (49.3%), the Middle East (28.2%) and Africa (11.7%). The largest proportion of immigrants was from the Middle East (49.2%), while a large majority of refugees in the study were from Asia (68.7%). In comparison to immigrant participants, refugees appeared to be disadvantaged with reference to many variables, such as being less likely to have finished high school, more likely to receive social assistance and more likely to be in the lower income categories. Immigrants were somewhat distributed amongst all income levels, while refugees were concentrated at the lower income levels.

***Growth and Development (see Table 2 and Table 3)***



Anthropometric measurements are presented in Table 2. In terms of percentile height for age, refugee children were significantly shorter than immigrants. Immigration status and the interaction of immigration status with region of origin were significant predictors of percentile height (see Table 3). Refugees, and especially refugee children from Asia, were at greater risk for lower percentile height; however, these variables only accounted for 18% of the variability. In alignment with this finding, refugee children were significantly more likely to have stunted growth compared to immigrant children.

Although a larger proportion of immigrant children were in the overweight and obese categories, there was no significant difference between the two groups. Older children, those with better educated parents, and those who consumed a poorer quality diet were at higher risk for being overweight/obese (See Table 4). Overall 10.1% of newcomer children in the current study were obese. More specifically, 12.9% of girls aged 3-6 years and 11.2% of girls aged 7-13 years were obese, while 9.7% of boys aged 3-6 years and 8.8% of boys aged 7-13 years were obese, which may indicate an emerging obesity concern among newcomer girls.

Immigrant children aged 11-13 years were at significantly higher risk of having waist circumference  $\geq 90$ th percentile than refugee children. However, logistic regression analysis that adjusted for region of origin, age, sex, parents' education, duration of residence, food security, sedentary activity, physical activity, serum vitamin D, calories and healthy eating index measure did not identify any significant predictors (See Table 2).

Immigrant children had significantly higher mean total body fat and mean trunk fat in comparison to refugees (see Table 5). In addition, immigrant children aged 8-13 years were at significantly higher risk of being overfat according to their percentage body fat. However, logistic regression did not produce any significant predictors, including region of origin, age, sex, parents'

education, duration of residence, food security, sedentary activity, physical activity, serum vitamin D, calories and healthy eating index measure.

### ***Health Status Indicators (See Table 6)***

Refugee and immigrant children were not significantly different in terms of blood pressure or blood glucose; however, refugee children were at significantly higher risk of having high blood cholesterol. Being a refugee and having higher saturated fat intakes were risk factors for high blood cholesterol; however, these variables only accounted for 11% of the variability. Sex remained a confounding variable in the final model so being female may be a protective factor against higher cholesterol levels.

The current study data indicates that level of sodium consumption was a predictor of hypertension/prehypertension among newcomer children. Newcomer children who consumed more sodium than the upper limit were at 2.7 times higher risk for hypertension/prehypertension than those who consumed lower amounts of sodium.

### ***Qualitative Results***

Many newcomer parents and service providers spoke about aspirations of attaining a good standard of living in Canada and current daily struggles to achieve this in the context of living on a low income for extended periods.

A service provider shared, "...refugees and immigrants are in survival mode because the doctor, engineer, professor are pushing shopping carts so they are in survival mode ...they are workaholics. On top of that they have to pay back their transportation loan."

A refugee was so disheartened by the difficulties with getting a good job and providing for his family that he asked to be sent back. He stated, "...they gave us pamphlets that said we

375 *train you according to your trade and skills...and we give you work...it is not like that...and I say*  
376 *I want to go back...the only skill to learn here is English...middle aged (people)...we have to*  
377 *take care of our family...we have to earn the money, have independence, and it is very hard.”*

378 Consistent with the quantitative health status data, healthcare provider and parent  
379 comments indicate concern that some newcomer children were gaining too much weight due to  
380 dietary changes. Given that healthcare providers are aware of healthy weights and current  
381 challenges with the Western diet and growing obesity trends, their comments often reflect this  
382 knowledge; while newcomer parents may not have had access to this information and some may  
383 come from environments where thin children were sickly and failed to thrive.

384 A Saskatoon healthcare provider noted, “...*obesity is a big problem...Obesity and iron*  
385 *deficiency anemia often together...I am not sure if it is actually a real trend, but obesity is a real*  
386 *problem...lots of them, between 25 and 50%, even if it’s just their BMI is at the 85<sup>th</sup> percentile*  
387 *or between 80<sup>th</sup> and 85<sup>th</sup>, which is still up there.”*

388 A Regina healthcare provider agreed, “...*the kids are gaining a lot of weight...they were*  
389 *tiny, normal weight, but then they all gain weight, majority is too much, more than ordinary. I*  
390 *can tell you about 50% gain a lot of weight...I know a lot of people change the way they eat,*  
391 *that’s why they gain so much weight...there is an abundance of food here.”*

392 Similarly an immigrant parent observed, “*When we came here my son was just five years*  
393 *old and she was just three and a half and they were in the range of normal weight, but now they*  
394 *are overweight, maybe because of the lack of physical activity and good food.”*

395 Other factors such as mental health problems, lack of knowledge about chronic health  
396 conditions, previous food deprivation that failed to support learning how to eat healthily, skewed  
397 parental healthy weight perceptions and heightened parental concern to ensure all of the

398 children's needs are well met also may have impacted dietary changes and led to excessive  
399 weight gain.

400 In regards to mental health, a Regina healthcare provider recounted, "...*I see children*  
401 *who are bullied and they can't fit in and they deal with their grief by eating. I have this family*  
402 *and most of their children have gained tons of weight and a couple of them are not feeling well,*  
403 *and because they get bullied more they suppress that feeling with eating.*"

404 Many newcomers do not understand the development of chronic disease as expressed by  
405 a Regina healthcare provider, "...*they think their children can have whatever they like, they don't*  
406 *think about healthy eating behavior...because they are already healthy. They don't see eating as*  
407 *a problem and...it can come to be trouble of a chronic condition.*"

408 In recognition that some refugee children come from deprived living conditions where  
409 they did not have the opportunity to develop healthy eating habits, a Regina immigrant service  
410 provider stated, "*Sometimes children coming from a refugee camp with very little to eat come*  
411 *here and eat too much.*"

412 Again with reference to the different backgrounds and knowledge sources, healthcare  
413 providers indicated some concerns regarding newcomer parents' perceptions of healthy child  
414 weights, which appear to be aligned with some parents' comments.

415 A Saskatoon healthcare provider observed, "...*perhaps there are some cultural*  
416 *differences in how we see healthy weights and how having nice chubby children is often seen as*  
417 *a good thing; chubby is fine, but obese is not OK. Often times I have trouble convincing my*  
418 *families that their child is obese or they are a nice healthy weight and they are seen as very*  
419 *skinny. I am not sure if it is related to stress of migration or comparing their child to other*

420 *children that they see around them or if their habits around eating changes dramatically when*  
421 *they come here.”*

422 A Saskatoon immigrant parent expressed concern about her daughter’s appetite and  
423 weight, although the child had a normal weight, “...(she) doesn’t eat too much and she is skinny,  
424 and she never puts on weight, I don’t know why...she doesn’t like to eat too much and I am  
425 always insisting some more food and eat this and she doesn’t like some things.”

426 In addition, a Saskatoon immigrant parent explained that it was his highest priority to  
427 respond to all of his children’s needs, which could lead to overfeeding, “...here kids are loved  
428 and they take care of their kids, but for us our association and bond is, I am very sensitive about  
429 my kids...I will provide everything to them I can.”

430 Some parents shared that they experienced very deprived conditions in refugee camps  
431 and now more commonly consumed meat and other foods in Canada, which can have positive or  
432 negative health impacts depending on the dietary changes.

433 A refugee parent described how his family’s dietary habits were incorporating more  
434 Western foods, “We buy Asian food mainly. Like rice we use every day in our home...We eat  
435 more meat here...In Thailand meat was very expensive and we could eat it only once or twice a  
436 month...but here we can eat it every day...We have a lot in Canada...They (children) eat pizza,  
437 sandwich, rice, vegetables, meat, oranges and apples, and drink milk and orange juice. It’s a  
438 different diet here...The kids want to buy pop to drink. We sometimes buy Pepsi, coca  
439 cola...They still eat traditional food, but they usually in Canada like to eat pizza, burgers and  
440 sandwiches...But now they don’t like rice too much.”

**Discussion:*****Growth and Development***

The current study data indicates an emerging trend where older immigrant children from privileged backgrounds may be at risk for overweight/obesity. The relationship may be mediated by beliefs that plump children are considered healthy as noted by some healthcare providers and parents in the current study, the primacy of responding to children's needs as noted by some newcomer parents, permissive child feeding patterns (Tovar et al. 2012), or lack of knowledge regarding how to prepare healthy meals because the parents' high social class in their home country allowed them to have hired help do all the meal preparation (Kwik 2008).

Many of the newcomer families were in a transitional phase in which they were working on establishing a life in Saskatchewan, so even parents with university education often did not have high incomes. Many comments reflected the economic struggles that many families experience over an extended time period. Families headed by parents with university education may have left behind lives in which they had a privileged lifestyle in a low-income country, which may put their children at risk for overweight/obesity.

This is consistent with the dramatic shift in global dietary patterns over the past 20 to 30 years, often referred to as the 'nutrition transition'. The nutrition transition has been described as major shifts in physical activity and dietary patterns that affect nutritional outcomes, including body composition and the development of chronic diseases (Popkin 2006). Popkin (2006) describes the nutrition transition as encompassing the process whereby as incomes rise, famine recedes, physical activity decreases, lifestyles become more sedentary, and diets become energy dense, which results in the increased incidence of chronic diseases and disability currently observed in many transitional countries and some high income countries. Accordingly, migrants

may arrive in Canada with compromised health status that sets the stage for an accelerated nutrition transition experience during their first few years in Canada, as opposed to the often observed nutrition transition that takes place over an expanded time frame across whole countries.

Van Hook and Balistreri (2007) have found a positive relationship between family social economic status (SES) and weight gain among older newcomer children (age 12 or older at arrival) and that this relationship was stronger among those from lower-income countries. However, weight gain among younger newcomer children (age 11 or less at arrival) appears to be more complicated. Among lower SES newcomer children from low-income countries, younger newcomer children were more at risk of weight gain than older children. This research aligns with the current study results indicating that older immigrant children from more privileged backgrounds in low-income countries are at risk for weight gain. The older privileged immigrant children may have experienced the combined impact of nutritional transition in both their country of origin and their new host country.

The current study data suggests that newcomer girls are more at risk of obesity than boys, which is opposite to the Canadian data. According to Carroll et al. (2015), 13% of Canadian children aged 3-19 years are obese. However, this figure varies by both age and sex as 10.3% of girls aged 3-6 years, and 8.7% of girls aged 7-12 years are obese, while 11.3% of boys aged 3-6 years, and 14.8% of boys aged 7-12 years are obese. Other researchers have also observed that immigrant girls are at increased risk for overweight/obesity due to cultural and religious expectations that include not participating in physical activity outside the household (Kirchengast and Schober 2006).

The complex relationship between migration and obesity may be mediated by a number of factors. Several studies have found a positive association between higher acculturation and body mass index among adult newcomers from low/middle income countries to high income countries, primarily the USA (Ahluwalia et al. 2007; Barcenas et al. 2007; Bertera et al. 2003; Fitzgerald et al. 2006; Franzen et al. 2009), which is often associated with exposure to obesogenic Western food environments (Fitzgerald et al. 2006). However, some newcomers maintain their traditional dietary habits (Flannery 2001). The social determinants of health approach may be more appropriate to understand the relationship between migration and obesity, as acculturation does not mechanistically lead to obesity; rather personal and social conditions before, during, and after migration must all be considered part of the obesity equation.

Understanding pathways to obesity among newcomer children is important to prevent chronic disease as obese children and adolescents are more likely to develop early health problems including hypertension, high triglycerides, hyperlipidemia, high cholesterol, and type II diabetes (Babington and Patel 2008) and to be obese as adults (The et al. 2010). There is also emerging research that waist circumference is an indicator of cardiovascular disease risk in children and youth as positive associations have been noted between waist circumference and chronic disease risk factors (Savva et al. 2000; Freedman et al. 1999). Among children, waist circumference has proven to a better predictor of cardiovascular disease risk factors than BMI (Janssen 2005). Among children in the overweight BMI category, the high waist circumference group was at 2 times greater risk of having high insulin levels, elevated triglyceride levels and metabolic syndrome as compared to the low waist circumference group.

Although no association between stunting and current family incomes was observed in the present study, there are likely links to previous periods of poverty. Ehounoux et al. (2009)



report that 20.4 % of children involved in the Quebec Longitudinal Study of Child Development who experienced at least two periods of poverty between 2.5 and four years of age also experienced growth delays ( $\leq 10^{\text{th}}$  percentile); however, only 9.5% of the never poor group experienced growth delays. This translated into a 3.43 higher risk to experience growth delays among the group of children who experienced long-term poverty during early life, compared to the never poor group. In addition, refugee children may be subjected to extreme stresses at early ages that can impact growth through possible physiologic changes in stress-sensitive systems (Fernald and Grantham-McGregor 2002).

### ***Chronic Health Conditions***

Overall, 52% of the newcomer children in the current study had unhealthy cholesterol levels ( $\geq 4.4\text{nmol/L}$ ) in comparison to the 35% of Canadian children aged 6-11 years who had unhealthy cholesterol levels ( $>4.5\text{nmol/L}$ ) in the 2009-2011 CHMS (Statistics Canada 2013). The current study observed that refugee children and those with higher saturated fat intakes were at risk for unhealthy cholesterol levels. Level of physical activity did not emerge as a significant factor. A body of evidence has identified low levels of physical activity and poor dietary behaviours as cardiovascular risk factors in general populations (Andersen et al. 2006; Lichtenstein et al. 2006), which likely play a similar role among newcomers. However, the refugee population may have also have experienced significant stresses associated with hardships during migration and with adjusting to Canadian life. Many parents and service providers spoke about the stresses associated with integrating into Canadian society, including economic and employment difficulties. Increased stress is a risk factor for elevated cholesterol levels (Thomas et al. 1985; Theorell and Aberstedt 1976). Unfortunately, many refugee families have lost their

531 social support network through migration and are in the process of establishing a new social  
532 network in Canada.

533 Lear et al. (2009), have observed that recent immigrant adults are at lower risk of  
534 atherosclerosis, in comparison to the Canadian-born; however, this risk increases with length of  
535 residency such that immigrants are at increased risk of atherosclerosis after 20 years of  
536 residency. Many newcomer children in the current study may be at risk for the development of  
537 cardiovascular disease, possibly earlier than the Canadian population, due to their unhealthy  
538 cholesterol levels.

539 Overall, 29% of newcomer children in the present study had borderline or elevated blood  
540 pressure, which is substantially higher than the 7% of Canadian children and youth aged 12 to 19  
541 years who were observed to have borderline or elevated blood pressure during the 2012 to 2015  
542 Canadian Health Measures Survey (CHMS) (Statistics Canada 2016). In addition, overweight  
543 and obese children and youth among this national cohort had significantly higher average blood  
544 pressure than children within normal weight range. Other research indicates that some ethnic  
545 groups, such as South Asian immigrants, are at higher risk for developing hypertension with  
546 longer residency in Canada, and that this risk is higher for women (Chiu et al. 2010).

547 In alignment with current study findings, an association between high sodium  
548 consumption and high blood pressure has been observed among some populations; however,  
549 most studies involve adult participants. The positive relationship between sodium excretion (a  
550 surrogate measure for intake) and increased blood pressure has been observed to be stronger  
551 among hypertensive individuals in comparison to those without hypertension in a pooled analysis  
552 (Mente et al. 2016). Therefore it is not clear whether high sodium intake is a primary driver  
553 behind increasing blood pressure among various populations.

## ***Health Disparities***

Whether children arrive in Canada as refugees or immigrants, many appear to be vulnerable to health disparities due to their families' social and economic conditions related to poverty and social marginalization combined with poor access to the inter-related systems of health, economic and social resources. This context generates living patterns focused on meeting survival needs as opposed to maximizing health status.

Health disparities among ethnic groups have been linked to psycho-social stresses such as having a tenacious and active coping style without resources to support goal attainment (James et al. 1983), institutional racism associated with differential job security (Levenstein et al. 2001), highly demanding job conditions with little individual control (Oths et al. 2001) and social support to moderate the stressful impact of status incongruence associated with failing to achieve a desired middle-class lifestyle (Dressler 1991).

The structural-constructivist model attempts to provide a framework to fully understand ethnic health disparities. It is built on the concept that the reality of life is largely a cognitive representation, built on a blend of socially shared understandings throughout a society, while individuals are embedded and constrained by external structures, especially social relationships based on the shared expectations of others (Dressler et al. 2005). Health disparities result from the social, psychological, and biological processes that occur within this intersection of social structure and cultural construction.

For example, Dressler and associates (Dressler 1991a; Dressler et al. 1998, 1999; Dressler & Bindon 2000) used this framework to understand blood pressure disparities among various groups in Brazil and the United States. All groups described their preference for a domestically comfortable lifestyle, not conspicuous consumption. Then, cultural consonance in

lifestyle was determined through examining the degree to which individuals were able to achieve their preferred lifestyle. Achievement of the preferred lifestyle was associated with lower blood pressure. In addition, Brazilians with darker skin color and higher cultural consonance had lower blood pressures than white Brazilians at any level of cultural consonance.

These results suggest that health disparities among ethnic groups can be reduced when individuals are able to achieve their desired level of socioeconomic attainment as encoded in culturally constructed lifestyles, such that the biosocial significance of skin color is diminished. Many parents in the current study commented on their disillusionment with life in Canada due to their difficulties with achieving their expected lifestyle, which could be linked to the health disparities observed among the children as per the structural-constructivist model.

The current study results also provide some support for the relevance of a trajectory model to understand health disparities among immigrants and refugees. Edberg et al. (2011) have proposed the use of a trajectory approach that incorporates interactions between various ecological factors to inform a deeper understanding of health disparities among newcomer populations. This approach acknowledges the recognized social determinants of population health, such as family income and poverty, and layers on the impact of newcomer experiences, including healthcare access issues, acculturative stress, differences in health knowledge and practice, perceived discrimination, lack of community efficacy to advocate for change, and resilience due to minority status group identification, as well as the lack of data to substantiate health disparities among some populations. Newcomers may experience vulnerabilities or resilience due to a variety of interactions between their attitudes, beliefs and practices, and their new host community responses to support successful settlement. The trajectory model advocates collecting data related to nine domains; migration experience, social adjustment, socio-economic

status, social supports, neighborhood characteristics, health status, health knowledge and practices, access to care and perceived discrimination. Although the current study incorporated data collection related to a number of the above domains, including family socio-economic status, children's health status, health knowledge and practices and access to care, a more robust approach including all domains could serve to better explain the health disparities observed among the immigrant and refugee children.

### **Conclusion:**

Health disparities exist among refugee and immigrant children to Canada and are likely influenced by a variety of intersecting pathways related to accelerated nutrition transition, their families' conceptualization of life in Canada, and social structures that limit progress to meeting their goals. Refugee children are at risk for stunting and high cholesterol, while immigrant children are more at risk for overweight/obesity, especially if they are older and from privileged backgrounds in low-income countries. Health and social service systems need to become sensitive to these risks to support effective screening and culturally sensitive health promotion programming to prevent chronic disease.

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<sup>1</sup>In this paper refugee refers to foreign-born individuals deemed as requiring protection according to the 1951 status of refugee convention who have been accepted into a host country; while immigrant refers to foreign-born individuals who have chosen to permanently reside in a host country; and newcomer refers to all foreign-born individuals currently living in a host country for a period not exceeding 5 years.

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**Table 1 Demographics and socio-economic status of participants\*\***

<b>Characteristics</b>	<b>Immigrants n=134 (44.7%)</b>	<b>Refugees n=166 (55.3%)</b>	<b>All participants n=300 (100%)</b>
Age (Mean±SD)	8.3±2.9*	7.8±2.7	8.0±2.8
<b>Sex</b>			
Male	75 (56.8%)	102 (61.4%)	177 (59.4%)
Female	57 (43.2%)	64 (38.6%)	121 (40.6%)
<b>Region of origin</b>			
Middle East (Ex. Iran, Iraq, Pakistan)	65 (49.2%)*	19 (11.4%)	84 (28.2%)
Asia (Ex. Burma, India, Philippines)	33 (25.0%)*	114 (68.7%)	147 (49.3%)
Africa	13 (9.8%)*	22 (13.3%)	35 (11.7%)
Latin-America	2 (1.5%)*	11 (6.6%)	13 (4.4%)
Eastern Europe	11 (8.3%)*	0	11 (3.7%)
Western Europe/ US	8 (6.1%)*	0	8 (2.7%)
<b>Education</b>			
Neither parent has high school diploma	7 (5.3%)*	128 (80.0%)	135 (46.2%)
At least one parent has high school diploma, some university or other education	27 (20.5%)*	19 (11.9%)	46 (15.8%)
At least one parent has university degree	98(74.2%)*	13 (8.1%)	111 (38%)
<b>Main source of income</b>			
Wages and salaries	114 (86.4%)*	88 (53.7%)	202 (68.2%)

Social assistance & Gov't Transfer	4 (3.0 %)*	75 (45.7%)	79 (26.7%)
Other (Scholarship, savings, none)	14 (10.6%)*	1 (0.6%)	15 (5.1%)
<b>Income Category (Adjusted for # of family members as per CCHS)</b>			
Lowest	37 (30.3%)*	58 (41.4%)	95 (36.3%)
Middle	42 (34.4%)*	71 (50.7%)	113 (43.1%)
Upper-middle	29 (23.8%)*	10 (7.1%)	39 (14.9%)
Highest	14 (11.5%)*	1 (0.7%)	15 (5.7%)
<b>Low Income Cut Off (LICO)</b>			
Income below LICO (Using # persons per	66 (54.5%)*	108 (77.1%)	174 (66.7%)
Income above LICO household)	55 (45.5%)*	32 (22.9%)	87 (33.3%)
<b>Length of stay in Canada in years</b> (Mean±SD)	2.0±1.6*	2.6±1.5	2.3±1.6

850 \* indicates significant difference between immigrants and refugees through chi squared at P<0.05

851 \*\*parents provided this information

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**Table 2 Children's Anthropometric measurements**

<b>Characteristics</b>	<b>Immigrants n=131 (44.3%)</b>	<b>Refugees n=165 (55.7%)</b>	<b>All participants n=296 (100%)</b>
Height in cm (Mean±SD)	130.9±18.5*	123.3±16.1	126.7±17.6
Percentile Height (Mean±SD)	52.5±31.2*	32.0±29.7	41.1±32.0
Stunted Growth (≤5 <sup>th</sup> percentile)	6 (4.6%)*	38 (23%)	44 (14.9%)
Weight in kg (Mean±SD)	32.1±14.2*	26.9±9.9	29.2 ±12.2
Percentile BMI (Mean±SD)	61.9 ±30.8	58.5±29.3	60.0±30.0
WHO criteria			
Underweight	3 (2.3%)	1 (0.6%)	4 (1.4%)
Normal	87 (66.4%)	131 (79.4%)	218 (73.6%)
Overweight	25 (19.1%)	19 (11.5%)	44 (14.9%)
Obese	16 (12.2%)	14 (8.5%)	30 (10.1%)
Waist circumference (Mean±SD)	61.9±11.5*	57.6±9.0	59.5±10.4
Waist circumference (11-13 years old, Canadian Standards)			

≥90 <sup>th</sup> percentile	18 (54.5%)*	5 (20.0%)	23 (39.87%)
<90 <sup>th</sup> percentile	15 (45.5%)*	20 (80.0%)	35 (60.3%)
Waist circumference (All ages, American Standards)			
≥90 <sup>th</sup> percentile	14 (10.8%)	10 (6.1%)	24 (8.2%)
<90 <sup>th</sup> percentile	116 (89.2%)	153 (93.9%)	269 (91.8%)

\* indicates significant difference between immigrants and refugees through chi squared at P<0.05

**Table 3 Predictors of percentile height**

Outcome variable	Constant	Regression coefficient		Total R <sup>2</sup>
		Immigration status (Immigrant = 0)	Immigration Status by Region (Asia = 0)	
Percentile height	47.70±9.65	-25.97±5.38	7.48±3.49	0.18
Partial R <sup>2</sup>		-0.29	0.13	
p-value		0.00	0.03	
Best fit multiple regression model. Confounding variables remaining in the final model include food insecurity, region of origin, caloric intake and serum vitamin D level.				

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Table 4 Predictors of percentile BMI

	Odds Ratio	95% Confidence Interval	p-value
Percentile BMI			
Age	1.18	1.03-1.35	0.017
Parents' education level			
Base: < highschool diploma			
Highschool diploma or some university	2.59	0.86-7.78	0.090
University degree	5.16	1.64-16.28	0.005
HEI diet quality score	0.94	0.90-0.99	0.020
Constant	2.14		0.702
Normal (0) vs. overweight/obese (1) best fit logistic regression Other confounders remaining in the final model include immigration status, region of origin, food security, sedentary activity, physical activity, serum vitamin D, and calories. Excluded variables include sex.			

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**Table 5 Children's Body composition measurements**

<b>Characteristics</b>	<b>Immigrants n=130 (44.7%)</b>	<b>Refugees n=161 (55.3%)</b>	<b>All participants n=291 (100%)</b>
<b>Total body fat</b> (grams) (Mean±SD)	9513.3±5868.2*	7458.5±4039.0	8389.8±5048.0
<b>Percent total body fat</b> (Mean±SD)	28.8±7.7*	26.7±7.4	27.7±7.6
<b>Weight Categories (8-13 years American DXA standards)</b>			
Obese ≥95 <sup>th</sup> centile	3 (3.9%)*	0 (0%)	3 (1.8%)
Overfat ≥85 <sup>th</sup> centile	10 (13.0%)*	3 (3.5%)	13 (8.0%)
Normal 5 <sup>th</sup> >85 <sup>th</sup> centile	55 (71.4%)*	71 (82.6%)	126 (77.3%)
Underfat <5 <sup>th</sup> centile	9 (11.7%)*	12 (14.0 %)	21 (12.9%)
<b>Weight Categories (5-13 years American anthropometric standards)</b>			
Obese ≥95 <sup>th</sup> centile	22 (20.6%)	30 (21.9%)	52 (21.3%)
Overfat ≥85 <sup>th</sup> centile	45 (42.1%)	40 (29.2%)	85 (34.8%)
Normal 5 <sup>th</sup> >85 <sup>th</sup> centile	40 (37.4%)	67 (48.9%)	107 (43.9%)
Underfat <5 <sup>th</sup> centile	0 (0%)	0 (0%)	0 (0%)
<b>Trunk fat</b> (grams) (Mean±SD)	3441.9±2513.7*	2846.3±1901.9	3116.2±2219.2
<b>Percent trunk fat</b> (Mean±SD)	25.2±8.3	23.4±7.8	24.2±8.1

864 \* indicates significant difference between immigrants and refugees through chi squared at P<0.05

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Table 6 Children’s Health status indicators

Characteristics	Immigrants n=130 (44.7%)	Refugees n=161 (55.3%)	All participants n=291 (100%)
<b>Systolic Blood Pressure (SBP)</b> (Mean±SD)	101.5±11.2	100.0±10.3	100.7±10.7
<b>At risk percentile SBP</b>			
Hypertensive (≥95)	7 (5.4 %)	7 (4.3%)	14 (4.8%)
Pre-hypertensive (≥90-<95)	8 (6.2%)	18 (11.2%)	26 (8.9%)
Normal	115 (88.5%)	136 (84.5%)	251 (86.3%)
<b>Diastolic Blood Pressure (Mean±SD)</b>	63.9±10.6	64.6±9.2	64.3±9.8
<b>At risk percentile DBP</b>			
Hypertensive (≥95)	12 (9.2%)	18 (11.3%)	30 (10.3%)
Pre-hypertensive (≥90-<95)	14 (10.8%)	19 (11.9%)	33 (11.4%)
Normal	104 (80.0%)	123 (76.9%)	227 (78.3%)
<b>Random capillary blood glucose</b> mmol/L (Mean±SD)	5.6±0.9	5.6±0.8	5.6±0.9
<b>High random capillary blood glucose</b> (≥7.8 mmol/L)	2 (1.6%)	4 (2.5%)	6 (2.1%)
<b>Blood cholesterol (mmol/L) (Mean±SD)</b>	4.3±0.63*	4.7±0.85	4.5±0.78
Normal	72 (57.6%)*	60 (40.0%)	132 (48.0%)
Borderline High ≥4.4 mmol/L	43 (34.4%)*	48 (32.0%)	91 (33.1%)
High ≥5.2mmol/L	10 (8.0%)*	42 (28.0%)	52 (18.9%)

\* indicates significant difference between immigrants and refugees through chi squared at P<0.0

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**Appendix A: 24 Hour Recall Questionnaire**

Time	Food Items	Type & Preparation	Amount	Brand Name or Where Bought
Morning				
Mid-morning				
Noon Meal				
Midday				
Evening Meal				
Before Bed				

2 Was this intake usual? Circle one: Yes / No if No, explain why not \_\_\_\_\_

3 Any vitamin/mineral intake during this time? Circle one: Yes / No if Yes, list names: \_\_\_\_\_

4

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**Appendix B: Vitamin D Food Frequency Questionnaire (FFQ)**

Type of food/ drink	Never or <1/ month	1/ month	2-3/ month	1/wk	2/wk	3- 4/ wk	5- 6/ wk	1/d	2+/d	Med. serving	Serving size		
											S	M	L
Milk: whole, 2%, 1%, or skim										1c (8oz or 250mL)			
Chocolate milk										1c (8oz or 250mL)			
Soy beverage fortified										1c (8oz or 250mL)			
Soy drink: plain (not fortified)										1c (8oz or 250mL)			
Other plant milks (rice, potato, etc)										1c (8oz or 250mL)			
Milk in coffee or tea										1 Tbsp			
Milk on cereal (if not included above)										½ c			
Milk shake										1c (8oz or 250mL)			
Milk dessert (ice cream, pudding)										½ c (1 scoop, 1 container)			
Yogurt (milk or soy)										½ c (125g, 1 container)			
Soft cheese										1 Tbsp			
Hard cheese										1 cube 2" (2 slices)			
White bread, bun, biscuit, roll, bagel, naan, tortilla										1 slice, 1 small roll, ½ bagel			
Dark bread, bun, biscuit, roll, bagel, naan, tortilla										1 slice, 1 small roll, ½ bagel			
Taco chips, nacho chips										1c (28g)			
Waffle, pancake, French toast										1 piece (4" round)			
Butter (in any foods eaten)										1 pat, 1 tsp			

Margarine (in any foods eaten)										1 pat, 1 tsp			
Tofu										1 cube 2"			
Macaroni with cheese										1c			
Canned salmon										2 Tbsp or 1c of casserole			
Canned tuna										2 Tbsp or 1c of casserole			
Type of food/ drink	Never or <1/ month	1/ month	2-3/ month	1/wk	2/wk	3- 4/ wk	5- 6/ wk	1/d	2+/d	Med. serving	Serving size		
											S	M	L
Salmon steak										90g (3oz)			
Other fish: white										90g (3oz)			
Other fish: oily										90g (3oz)			
Cream soups made with milk										1c (8oz or 250mL)			
Taco or burrito with cheese										1 taco or ½ burrito			
Pizza with cheese										1 slice			
Lentils, beans, peas										½ c cooked			
Eggs: eaten alone or in other foods										1 large egg			
Orange juice: not fortified with calcium & vit D										1c (8oz or 250mL)			
Orange juice: fortified with calcium & vit D										1c (8oz or 250mL)			
Broccoli, kale, greens										1c raw or ½ c cooked			
Seafood (eg. Shrimp or crab)										1c meat			

Beef or pork										90g (3oz)			
Bacon or sausage										2 slices or 2 links			

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### Appendix C: Children's Physical Activity (CPA) Questionnaire

Physical activity is any activity that increases your heart rate and makes you get out of breath some of the time. It can be done in sports, school activities, playing with friends, or walking to school. Some examples of physical activity are running, brisk walking, dancing, swimming, rollerblading, skateboarding, biking, soccer, basketball and football.

For these first two questions, add up all the time you spend doing physical activity each day.

1. Over the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day?

None (zero days) ☐

1 day ☐

2 to 3 days ☐

4 days or more ☐

2. Over a typical or usual week, on how many days are you physically active for a total of at least 60 minutes per day?

None (zero days) ☐

1 day ☐

2 to 3 days ☐

4 days or more ☐

3. About how many hours a week do you usually take part in physical activity (that makes you out of breath or warmer than usual) in your free time at school (for example, at lunch)?

Never ☐

Less than 2 hours per week ☐

2 to 3 hours per week ☐

4 to 6 hours per week ☐

7 or more hours per week ☐

N/A-not in school ☐

4. About how many hours a week do you usually take part in physical activity (that makes you out of breath or warmer than usual) in this class time at school?

Never ☐

Less than 2 hours per week ☐

44 2 to 3 hours per week ☐

45 4 to 6 hours per week ☐

46 7 or more hours per week ☐

47 N/A-not in school ☐

48

49

50 5. About how many hours a week do you usually take part in physical activity (that makes you out of  
51 breath or warmer than usual) **outside of school** while participating in lessons or **league or team sports**?

52 Never ☐

53 Less than 2 hours per week ☐

54 2 to 3 hours per week ☐

55 4 to 6 hours per week ☐

56 7 or more hours per week ☐

57

58 6. About how many hours a week do you usually take part in physical activity **outside of school** while  
59 participating in **unorganized activities** (ie. playing after school or on weekends), either on your own or  
60 with friends?

61 Never ☐

62 Less than 2 hours per week ☐

63 2 to 3 hours per week ☐

64 4 to 6 hours per week ☐

65 7 or more hours per week ☐

66

67 7. About how many hours/day do you watch TV/videos or play video games (not including school time)?

68 Don't watch TV or videos or play video games ☐

69 Less than 1 hour a day ☐

70 1 to 2 hours a day ☐

71 3 to 4 hours a day ☐

72 5 to 6 hours a day ☐

73 7 or more hours a day ☐

74

8. On average, about how many hours a day do you spend on a computer (working, playing games, e-mailing, chatting, surfing the Internet, etc.) (does not include during school time)?

Don't spend time on the computer ☐

Less than 1 hour a day ☐

1 to 2 hours a day ☐

3 to 4 hours a day ☐

5 to 6 hours a day ☐

7 or more hours a day ☐

### Sun Exposure (SEB)

The next two questions are about your exposure to the sun since you have been in Canada. For these questions, think about a typical weekend or day off from school in the summer months.

1. About how much time each day do you spend in the sun between 11 am and 4 pm?

None ☐

Less than 30 minutes ☐

30 to 59 minutes ☐

1 hour to less than 2 hours ☐

2 hours to less than 3 hours ☐

3 hours to less than 4 hours ☐

4 hours to less than 5 hours ☐

5 hours ☐

2. In the summer months, on a typical weekend or day off from school, when you are in the sun for 30 minutes or more, how often do you use sunscreen?

Always ☐

Often ☐

Sometimes ☐

Rarely ☐

Never ☐

**Appendix D: Socio-demographic (SD) Questionnaire**

First Name: Last name:  
Home Address: Phone number:  
Household type (ie. mother only, father only, both parents):  
First name of subject’s mother: Last name of subject’s mother:  
First name of subject’s father: Last name of subject’s father:  
Total number of individuals in the household: Number of children in household:

Age and sex of children including the study participant (add more columns if needed):

Child 1	Child 2	Child 3	Child 4	Child 5
Age	Age	Age	Age	Age
Sex	Sex	Sex	Sex	Sex

**Age/sex of participant**

1. Participant’s Date of Birth (MM/DD/YY):

Participant’s Calculated Age: Participant’s Sex:

2. Mother’s Date of Birth (MM/DD/YY):

Mother’s Calculated Age:

Father’s Date of Birth (MM/DD/YY):

Father’s Calculated Age:

**Medical History**

3. Has your child (the participant) ever broken a bone? If so, indicate which bone and at what age.

☐ Yes Indicate which bones \_\_\_\_\_

☐ No

4. Does your child take calcium or vitamin D supplements?

☐ Yes Indicate which ones and how much \_\_\_\_\_

☐ No

5. Has your child ever been diagnosed by a healthcare professional as being malnourished and/or treated for malnutrition? If so, describe condition and treatment. (probe for symptoms, underweight, failure to thrive, length of hospitalization, treatment provided) \_\_\_\_\_

6. Has your child ever received medical attention for severe diarrhea? If so please describe the episode and treatment (probe for severity of diarrhea, other symptoms, length of hospitalization, treatment provided) \_\_\_\_\_



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148 7. For how long was your child exclusively breastfed?

149 ☐ Never breastfed150 ☐ <6 months151 ☐ 6months-1 year152 ☐ longer

153

154 8. At what age did you start to give any other foods besides breastmilk to your child (includes formula,  
155 other liquids and solid foods)?156 ☐ <1 months157 ☐ 1 month to <2 months158 ☐ 2 months to <3 months159 ☐ 3 months to <4 months160 ☐ 4 months to <5 months161 ☐ 5 months to <6 months162 ☐ 6months-12 months163 ☐ 1-2 years164 ☐ 2-3 years

165

166 9. At what age did you start to give solid foods to your child (eg. cereal, fruits, vegetables, meats)?

167 ☐ <1 months168 ☐ 1 month to <2 months169 ☐ 2 months to <3 months170 ☐ 3 months to <4 months171 ☐ 4 months to <5 months172 ☐ 5 months to <6 months173 ☐ 6months-12 months

174 ☐ 1-2 years

175 ☐ 2-3 years

176

177 **10.** At what age did you stop breastfeeding your child?

178 ☐ Never breastfed

179 ☐ 1 month to <2 months

180 ☐ 2 months to <3 months

181 ☐ 3 months to <4 months

182 ☐ 4 months to <5 months

183 ☐ 5 months to <6 months

184 ☐ 6months-12 months

185 ☐ 1-2 years

186 ☐ 2-3 years

187 ☐ > 3 years (fill in year)\_\_\_\_\_

188

189 **11.** Indicate your child's birth weight (include units).\_\_\_\_\_

190 ☐ unknown

191

192 **12.** Was your child born prematurely? If so, indicate length of gestation:

193 ☐ No

194 ☐ full term

195 ☐ 4-6weeks premature

196 ☐ 6-10 weeks premature

197 ☐ >10 weeks premature

198

199 **Socio-demographic characteristics (SDC)**

200

201 **13.** Indicate your migration status:

202 ☐ immigrant (permanent resident)

203 ☐ refugee (permanent resident)

204 ☐ Canadian Citizen

205 ☐ student or worker (temporary resident)

☐ non status (unrecognized immigrant)

**14.** In what country was your child born?

**15.** What date did you (participant) first come to Canada (MM/DD/YY) (must be < 5 years)? If the participant was born in Canada, indicate when family arrived. \_\_\_\_\_

**16.** People living in Canada come from many different cultural and racial backgrounds. Are you:

White ☐ Chinese ☐ South Asian (e.g., East Indian, Pakistani, Sri Lankan) ☐ Black ☐

Latin American ☐ Southeast Asian (e.g., Cambodian, Indonesian, Laotian, Vietnamese, Burmese) ☐

Filipino ☐ Arab ☐ West Asian (e.g., Afghan, Iranian) ☐ Japanese ☐ Korean ☐

**17.** What languages do you speak (list all, including English)?

**18.** What language do you speak most often at home?

**19.** What is the language that you first learned at home?

**20.** Can you still...?

☐ speak and understand your first language

☐ only understand your first language

☐ neither speak nor understand your first language

### **Education (EDU)**

**21.** What is your (participant's) highest grade of elementary school completed in your home country?

**22.** What grade of elementary school are you (participant) in here in Canada?

**23.** Father's education in home country:

☐ <grade 8

☐ <grade 12

☐ high school diploma

☐ some University

☐ University degree-Indicate highest degree \_\_\_\_\_

☐ Trade/other education-Indicate certification \_\_\_\_\_

☐ refuse to answer

24. Father’s education in Canada:

- ☐high school diploma
- ☐some University
- ☐University degree-Indicate highest degree \_\_\_\_\_
- ☐Trade/other education-Indicate certification \_\_\_\_\_
- ☐refuse to answer

25. Mother’s education in home country:

- ☐ <grade 8
- ☐ <grade 12
- ☐high school diploma
- ☐some University
- ☐University degree-Indicate highest degree \_\_\_\_\_
- ☐Trade/other education-Indicate certification \_\_\_\_\_
- ☐refuse to answer

26. Mother’s education in Canada:

- ☐high school diploma
- ☐some University
- ☐University degree-Indicate highest degree \_\_\_\_\_
- ☐Trade/other education-Indicate certification \_\_\_\_\_
- ☐refuse to answer

Income (INC)

Although many health expenses are covered by health insurance, there is still a relationship between health and income. Please be assured that, like all other information you have provided, these answers will be kept strictly confidential.

27. What is your best estimate of the total income, before taxes and deductions, of all household members from all sources in the past 12 months? If participant has been in Canada less than 12 months, indicate average per month and multiply by 12. \_\_\_\_\_ refuse to answer ☐

**28.** Thinking about the total income for all household members, from which of the following sources did your household receive any income in the past 12 months? If participant has been in Canada less than 12 months, indicate sources of income since arrival in Canada.

Wages and salaries ☐ Income from self-employment ☐ Dividends and interest (e.g. bonds, savings) ☐  
Worker's compensation ☐ Retirement pensions, superannuation and annuities ☐ Old age security and  
guaranteed income supplement ☐ Provincial or municipal social assistance or welfare ☐ Child tax  
benefit ☐ Child support ☐ Alimony, other (e.g., rental income, scholarships) ☐ Refuse to answer ☐

**29.** What was the main source of income?

Wages and salaries ☐ Income from self-employment ☐ Dividends and interest (e.g. bonds, savings) ☐  
Worker's compensation ☐ Retirement pensions, superannuation and annuities ☐ Old age security and  
guaranteed income supplement ☐ Provincial or municipal social assistance or welfare ☐ Child tax  
benefit ☐ Child support ☐ Alimony, other (e.g., rental income, scholarships) ☐ Refuse to answer ☐

**30.** Can you estimate in which of the following groups your household income falls?  
Was the total household income from all sources:

less than \$5,000 ☐  
\$5,000 to less than \$10,000 ☐  
\$10,000 to less than \$15,000 ☐  
\$15,000 to less than \$20,000 ☐  
\$20,000 to less than \$25,000 ☐  
\$25,000 to less than \$30,000 ☐  
\$30,000 to less than \$40,000 ☐  
\$40,000 to less than \$50,000 ☐  
\$50,000 to less than \$60,000 ☐  
\$60,000 to less than \$80,000 ☐  
\$80,000 to less than \$100,000 ☐  
\$100,000 or more ☐

Appendix E: Food security (FS) Questionnaire

The following questions are about the food situation for your household in the past 12 months. If you/your family have been in Canada less than 12 months, consider only time spent in Canada since your arrival.

1. Which of the following statements best describes the food eaten in your **household** in the past 12 months, that is, since [current month] of last year:
- a) Have you and the other members of your household always had enough of the kinds of food you wanted to eat?
  - b) Have you and the other members of your household had enough to eat, but not always the kinds of food you wanted?
  - c) Have there been some times when you and the other members of your household have not had enough to eat?
  - d) Have you and the other members of your household often not had enough to eat?

For the following questions, please tell me if the statement was often true, sometimes true, or never true for you and the other members of your household in the past 12 months (or since arrival in Canada).

2. The first statement is: You and the other members of your **household** worried that food would run out **before you got money to buy more**. Was that often true, sometimes true, or never true in the past 12 months?  
Often true ☐      Sometimes true ☐      Never true ☐
3. The food that you and the other members of your **household** bought did run out and there **wasn't any money to get more**. Was that often true, sometimes true, or never true in the past 12 months?  
Often true ☐      Sometimes true ☐      Never true ☐
4. You and the other members of your **household couldn't afford** to eat balanced meals. Was that often true, sometimes true, or never true in the past 12 months?  
Often true ☐      Sometimes true ☐      Never true ☐
5. You and the other members of your household relied on only a few kinds of low-cost food to feed **Child Name** because you were **running out of money** to buy food. Was that often true, sometimes true, or never true in the past 12 months?  
Often true ☐      Sometimes true ☐      Never true ☐
6. You and the other members of your household couldn't feed **Child Name** a balanced meal, because you couldn't afford it. Was that often true, sometimes true, or never true in the past 12 months?  
Often true ☐      Sometimes true ☐      Never true ☐
7. **Child Name** was not eating enough because you and the other members of your household just **couldn't afford enough food**. Was that often, sometimes, or never true in the past 12 months?  
Often true ☐      Sometimes true ☐      Never true ☐

The following few questions are about the food situation in the past 12 months for you or any other adults in your household.

8. In the past 12 months, since last [current month] did **you or any other adult members of your household** ever cut the size of your meals/eat less at meal time or skip meals (ate less than usual) because there **wasn't enough money** for food?
  - 8.a How often did this happen---almost every month, some months but not every month, or in only 1 or 2 months?
9. In the past 12 months, did **you (personally)** ever eat less than you felt you should because there **wasn't enough money** to buy food?
10. In the past 12 months, were **you (personally)** ever hungry but didn't eat because you **couldn't afford** enough food?
11. In the past 12 months, did **you (personally)** lose weight because you **didn't have enough money** for food?
12. In the past 12 months, did **you and the other adult members of your household** ever not eat for a whole day because there **wasn't enough money** for food?
  - 12.a How often did this happen---almost every month, some months but not every month, or in only 1 or 2 months?

Now, a few questions on the food experiences for children in your household

13. In the past 12 months, did you or the other members of your household ever cut the size of your **child's** meals so that they ate less than usual because there **wasn't enough money** for food?
14. In the past 12 months, did your **child** ever have to skip meals because there **wasn't enough money** for food?
  - 14a. How often did this happen---almost every month, some months but not every month, or in only 1 or 2 months?
15. In the past 12 months, was your **child** ever hungry but you just **couldn't afford** more food?
16. In the past 12 months, did your **child** ever not eat for a whole day because there **wasn't enough money** for food?