

International Inuit Cohort Study: Developing the Next Phase

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Abstract

The International Inuit Cohort Study (IICS) was born from an international collaborative effort to gather pertinent data from Inuit circumpolar populations in order to identify differences and trends in this population. This cohort study addresses long-standing questions with respect to Inuit health research. Many studies among Inuit populations are limited by a lack of statistical power, weak external validity and absence of temporal links and causality between disease and potential etiologic factors. Indeed, the small size of communities (between 50 and 5000) living in different regions of the Arctic limits the use of epidemiological studies to determine rates of health outcomes. This initiative is based on three different companion studies conducted among Inuit adults in Canada and Greenland. Each study has a cross-sectional and a longitudinal component. The protocols used were developed in close collaboration and are very similar. The baseline surveys were carried out among adults (18 years) with Inuit/Yupik ancestry in the Canadian Arctic and Greenland. From 2004 to 2010, a total of 6223 individuals were recruited as part of three surveys: Qanuipitaa? How are we? Nunavik Inuit Health Survey 2004 (n=929); Inuit Health in Transition – Greenland Survey 2005-2010 (n=3108); International Polar Year - Inuit Health Survey (IPY-IHS) in Nunavut, Inuvialuit Settlement Region, and Nunatsiavut 2007-2009 (n=2459). Individuals participated to 3-4 hours session, including answering to interviewer- and self-administered English/Inuktitut questionnaires to ascertain a range of various lifestyle habits and health outcomes, and to medical and para-clinical examination (with biological samples drawn). At the outset, the IICS project was conducted across the three inhabited ArcticNet IRIS regions in Canada, and extended to Greenland. IICS deals with all aspects of the Cohort, including its constitution as a databank and all activities to further gather data to augment the databank. It builds on previous work on the vulnerabilities of Arctic communities, and it is feasible because of established collaborations with northern people and organizations. The project documents the changing physical, biological and

socioeconomic conditions that are affecting people across the circumpolar North and identifies policies and strategies to assist communities in dealing with these changes. However, an agreement has yet to be reached between Inuit regions involved in the IPY-Inuit Health Survey (and especially Nunavut) and principal investigators regarding the governance of data from this survey. Therefore, the work for 2014-2015 involved data analyses only from the Nunavik and Greenland health surveys. In recent years of the project, a new component of the Inuit Cohort Study has emerged focussing on the social determinants of Inuit health, among which community and housing conditions. This component follows three objectives: 1) documenting associations between communities' socioeconomic conditions and health in Nunavik and Greenland; 2) documenting associations between household overcrowding and psychosocial health in Nunavik and Greenland; and 3) assessing the impacts of moving to a new house for Inuit health and well-being in Nunavik and Nunavut.

Key Messages

- An international integral data platform supporting cross-disciplinary research in the Inuit circumpolar region has been completed in 2013. This International Inuit Cohort Study (IICS) platform will be operational in January 2014, enabling the query of data from 2 or 3 of the Inuit Health survey datasets. This data repository consists of a total of 253 variables (191 harmonized data and 62 newly created data) among 6777 individuals across Greenland, Nunavik, Nunavut, Nunatsiavut, and the Inuvialuit Settlement Region.
- Research on the socioeconomic determinants of Inuit health demonstrated that higher household crowding in the Arctic is significantly associated with elevated chronic stress levels and with poorer mental well-being among the circumpolar Inuit. These observations are especially significant among women. Reducing household

crowding, through housing policies, is likely a key strategy to improve Inuit health and well-being.

- There are social and geographical inequalities in hypertension among Greenlandic Inuit. Adjusting for age, sex and known risk factors, blood pressure is higher among people with lower household wealth and in communities with lower average disposable household income.
- Association between mercury and/or persistent organic pollutants (POPs) exposure and atherosclerosis and hypertension have been demonstrated among circumpolar Inuit, although the pattern of association is complex, notably between different age groups.
- We are planning for a follow-up to the Nunavik Inuit Health Survey, with field operations beginning in 2015.
- Research proposals have been submitted to provincial (FRQS) and federal (CIHR) funding organizations that builds on the scientific articles conducted as part of this ArcticNet-funded project.

Objectives

1. Finalize and manage the international data platform of the International Inuit Cohort Study (IICS) for new data inventory, data sharing, and to ensure the sustainability and accessibility of the data in the long-term. As we hope that the development of such a data platform across heterogeneous cohort studies will serve as a model for other regions, we plan to publish the different procedures of data harmonization and standardization that were utilized.
2. Analyze data from the IICS, either the fully-merged cohort or independent studies from the cohort in a comparative perspective.
3. Prepare the 2015 follow-up of the baseline Nunavik Inuit Health Survey (2004) planned for 2015

(Exploratory research; workshop and planning; ongoing collaboration) .

4. Expand ongoing research on housing and community conditions through submission of research protocols.

Introduction

Several studies have documented inequality in health status for Inuit populations in comparison with other populations. In general, Inuit populations demonstrate health status outcomes (i.e. mortality, morbidity and health perception measures) that are inferior to other Indigenous populations in Canada and to Caucasian populations. Demographically they are greatly susceptible to disadvantages associated with having a very young demographic profile for they are the youngest Indigenous population in Canada (i.e. resource and infrastructure pressures including housing). Finally, the study of biomarkers (e.g. blood pressure, fatty acid signatures, environmental contaminant, body burdens, etc.) also contribute to understanding and describing the scenario of epidemiological transition among Inuit populations, indicating the possible (even likely) onset of a chronic disease epidemic (cardiovascular, diabetes) triggered by a shift in traditional lifestyle and diet towards more sedentary lifestyle in which market foods are much more present in the diet.

The International Inuit Cohort Study is a composite of three cross-sectional health surveys conducted in Canada and Greenland between 2004 and 2010, creating the largest databank for Inuit health to date. Chronologically the first survey, referred to as the “Qanuippitaa? How are we? Survey” was conducted in Nunavik in 2004 (929 adult participants). The second took place over a period of 4 years over the entire territory of Greenland (2005-2009 – 2834 adult participants), the “Inuit Health in Transition 2005-2010”. Finally, conducted in 2007 and 2008, the International Polar Year Adult Inuit Health Survey 2007–2008 (IPY-IHS) covers a vast area including

Nunavut, Nunatsiavut and the Inuvialuit Settlement Region (ISR) (2595 adult participants). All participants have provided consent to be contacted for a follow-up investigation, and thus have consented to be part of the International Inuit Cohort. A web site at <http://circumpolarcohort.crchuq.ca/index.htm> provides further information.

The three studies have pursued common goals and have adopted similar methods focused on measuring the epidemiological transition of Inuit populations and the pursuit of knowledge to inform: the risks and benefits of key aspects of this transition as well as improving health outcomes (e.g. chronic diseases, self-inflicted injuries). The information gathered from participants over the course of the field operations have included variables that represent the determinants of health (e.g. food security and nutrition; education; employment; revenue; housing; culture; social support, and more..), demographic information, and health outcomes information (perceived health status; clinical health status) for the populations of these Inuit regions. It is important to collect baseline health status data and their relationship to environmental factors including contaminants and lifestyle among Inuit communities in the circumpolar region.

In 2013, an integral data platform for the three heterogeneous, cross-disciplinary and multi-scale datasets collected from the three surveys has been developed. Its structure provides an excellent opportunity for extension with the future follow-up of the three existing cohort studies. In addition, several research activities have been conducted in order to better document socio-environmental factors, such as housing and community conditions, associated with Inuit health.

Activities

Objective 1: Development and harmonization of the International Inuit Cohort Study

January-April 2013

Development of the data repository

(collaboration with Laurie Chan, Ottawa U.; Kue Young, U of Toronto; Peter Bjerregaard, Greenland Health; Mélanie Lemire, Mylène Riva, Michel Lucas, Elhadji Annassour)

Data harmonization and standardization procedures

Data harmonization and standardization procedures have been carried out in order to achieve data comparability among three datasets and provide a united form for these data. It consisted of adjusting differences and inconsistencies among data definition and measurements to make them mutually compatible.

The data harmonization process was verified with persons knowledgeable to account for the cultural and regional characteristics of the underlying health surveys, both in the meaning of source variables and in the transformation of source variables into target variables. To meet this need, an advisory committee of researchers (PIs and collaborators) was formed at the beginning of the harmonization process and consulted on a regular basis to allow for harmonizing concepts, definitions, classifications, questions and data outputs.

Creation of a framework of the methodological procedures

A standardized stepwise approach was followed for the procedure of data harmonization and standardization. The six stage-based workflow was as follows (Figure 1):

1. Qualitative harmonization
2. Quantitative harmonization

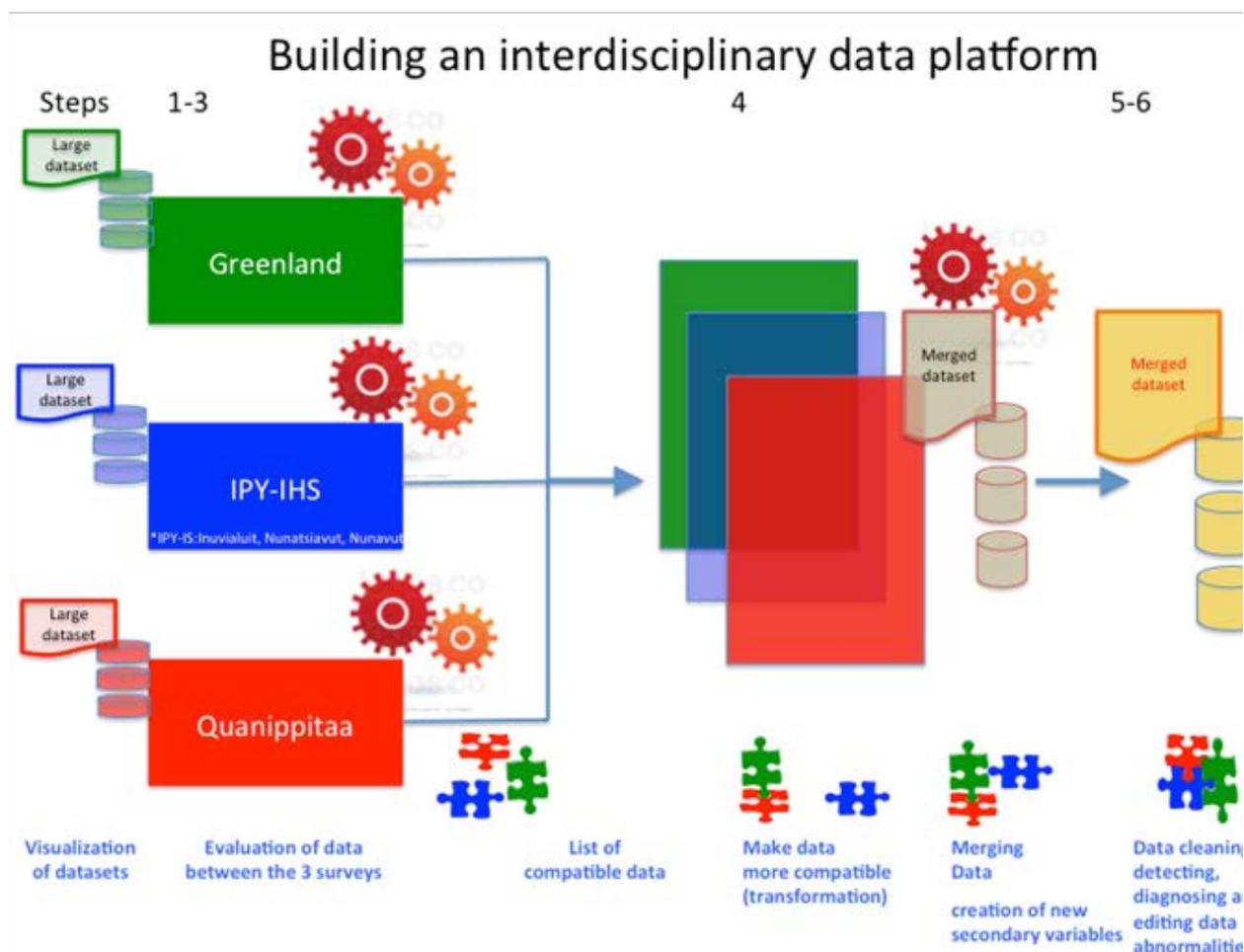


Figure 1. Description of the procedures

3. Statistical harmonization

April 2013

4. Data transformation and creation of the data repository

Meeting of the advisory committee of researchers on April (22th) about the data harmonization process.

5. Creation of a data inventory book

May-June 2013

6. Quality check

Creation of a comparison table of bio-chemical methods

A table comparing the methods used in clinical biochemistry, clinical tests, nutrient status and environmental contaminants across the three surveys, was completed. This table consists of sample preparation, matrix, sample analysis and location.

Completion of the previous documents following the recommendations of the experts; Beginning of data pooling of the three surveys into one sole database; Preparation of the workshop on data management for June 2013; Preparation of a workshop about study design and data management.

17-18 June 2013

Organization, participation and facilitation at the data management workshop held at the Santé des populations et pratiques optimales en santé, Centre de recherche du CHU de Québec. This workshop was for training for young researchers about developing study design and data management.

July-September-October 2013

Completion of data merging and creation of the merged dataset. Preparation of a workshop about data analysing in big datasets.

15-16 October 2013

Organization, participation and facilitator at the data management workshop held at the Santé des populations et pratiques optimales en santé, Centre de recherche du CHU de Québec. This workshop was for training for young researchers about data analysing in big datasets.

November 2013

Data cleaning and validation tests of the merged dataset.

December 2013

Participation in the annual scientific meeting of ArcticNet, 9-13 December 2013, Halifax, Nova Scotia. Oral presentation about the merged dataset on the 12th of December: Aline Philibert, Peter Bjerregaard, Eric Dewailly, Kue Young and Laurie Chan. An international data repository supporting cross-disciplinary research in the Inuit circumpolar region.

Objective 2: Analyses of data from the IICCS

(Eric Dewailly, Mylène Riva, Claire Dupont, Beatriz Valera)

Several statistical analyses using data from the independent studies composing the IICS, but analysed in a comparative perspective, were conducted and published in peer-reviewed journals, as listed below.

Publications:

Bjerregaard P, Pedersen HS, Nielsen NO, Dewailly E. Population surveys in Greenland 1993-2009: temporal trend of PCBs and pesticides in the general Inuit population by age and urbanisation. *Sci Total Environ*. 2013 Jun 1;454-455:283-8.

Paunescu AC, Ayotte P, Dewailly E, Dodin S, Pedersen HS, Mulvad G, Côté S. Polyunsaturated fatty acids and calcaneal ultrasound parameters among Inuit women from Nuuk (Greenland): a longitudinal study. *Int J Circumpolar Health*. 2013 Jun 5;72:20988.

Paunescu AC, Ayotte P, Dewailly E, Dodin S. Dioxin-like compounds are not associated with bone strength measured by ultrasonography in Inuit women from Nunavik (Canada): results of a cross-sectional study. *Int J Circumpolar Health*. 2013 May 29;72

Riva, M., Plusquellec, P., Juster, R.P., Laouan-Sidi, E.A., Abdous, B., Lucas, M., Déry, S., Dewailly, E. Household crowding is associated with higher allostatic load among Inuit. *Journal of Epidemiology and Community Health*. doi:10.1136/jech-2013-203270

Riva, M., Lytken Larsen, C.V., Bjerregaard, P. Household crowding and psychosocial health among Greenlandic Inuit. *International Journal of Public Health*. Under review

Riva, M., Lytken Larsen, C.V., Bjerregaard, P. Social and geographic inequalities in blood pressure among Inuit in Greenland. A multilevel study. To be submitted to *Journal of Hypertension*.

Rudkowska I, Ouellette C, Dewailly E, Hegele RA, Boiteau V, Dubé-Linteau A, Abdous B, Proust F,

Giguère Y, Julien P, Château-Degat ML, Vohl MC. Omega-3 fatty acids, polymorphisms and lipid related cardiovascular disease risk factors in the Inuit population. *Nutr Metab (Lond)*. 2013 Mar 12;10(1):26.

Valera B, Jørgensen ME, Jeppesen C, Bjerregaard P. Exposure to persistent organic pollutants and risk of hypertension among Inuit from Greenland. *Environmental Research* 122 (2013) 65–73.

In addition, our team presented their work at national and international conferences, as listed below.

Conference presentations:

Dewailly, E. Risques et bénéfices de l'alimentation traditionnelle inuit. Collège de France, Grand Chantier Arctique Français. Paris, France, 3-6 juin 2013.

Dewailly. De la recherche à l'intervention : une expérience de 25 ans chez les Inuit. Conférence dans le cycle Santé des Populations éloignées. Université de Lausanne, Suisse. 22 mai 2013.

Dewailly, E. Annual NCP workshop. Health issues facing Canada's Northern populations. Ottawa, 23-26 September 2013.

Dewailly, E., Rouja, P. UTSUQ a story of fat. Bermuda Underwater Exploration Institute. Public Lecture. November 8, 2013, Hamilton, Bermuda.

Dewailly, E., Ayotte, P., Muckle, G., Riva, M., Lucas, M., Lemire, M. 25 years of scientific progress on contaminants and health in the Arctic. *Arctic Frontiers* 2014, Tromsø, Norway, 19-25 January 2014.

Dupont, C., Noël, M., Laouan-Sidi, EA., Dewailly, E. Assessing atherosclerosis and its risk factors among the James Bay Cree communities, Nituuchischaayihitaa Aschii: Multicommunity Environment and Health Longitudinal Study in Iiyiyiu Aschii, 2005-2009. 10e conférence nationale des étudiant(e)s en études nordique : "NIKAN, L'avenir du Nord" - UQAT - Val d'Or - 2 November 2012.

Dupont, M Noël, EA Laouan-Sidi, LF Daigle, K Young, E Dewailly. Mercury exposure and atherosclerosis: preliminary results of a study among adults aged 40 and older with different levels of contamination in Canada. 11th International Conference on Mercury as a Global Pollutant, Edinburgh, Scotland, July-August 2013.

Furgal C and Lemire M. (2012) The Story of Mercury Communication in Nunavik 1979-2012. Inuit Tapiriit Kanatami Conference, Ottawa – Canada, March 15-17.

Lemire M, Ayotte P, Dumas, P, Dewailly E. Country food and cardiovascular health in Inuit: a complex balance between risks and benefits. 11th International Conference on Mercury as a Global Pollutant. United Kingdom, Edinburgh, August 2, 2013.

Philibert, A., Bjerregaard, P., Dewailly, E., Young, K., and Chan, L. 2013. International Inuit Cohort (ICC): International Platform for Collaborative Outcomes Research in Contaminant Exposure and Health Issues in the Inuit Circumpolar Region. Poster presentation at the Northern contaminants program 20th annual results workshop, September 24-25, 2013, Ottawa, Ontario, Canada.

Philibert, A., Bjerregaard, P., Dewailly, E., Young, K., and Chan, L. 2013. An international data repository supporting cross-disciplinary research in the Inuit circumpolar region. Oral presentation at ArcticNet's 9th Annual Scientific Meeting (ASM2013), December 9-13, 2013, Halifax, Nova Scotia, Canada.

Riva, M. 2013. Housing conditions and health in the Arctic. ArcticNet 9th Annual Meeting. Halifax, December 2013.

Riva, M., Plusquellec, P., Cartier, C., Juster, R.P., Lucas, M., Déry, S., Dewailly, E. Surpeuplement des logements et stress chronique au Nunavik. 17e Journées Annuelles de Santé Publique du Québec. Montréal, Novembre 2013. **Mention d'honneur: seconde place**.

Objective 3: Prepare the follow-up to the baseline Nunavik Inuit Health Survey

Discussions between Eric Dewailly (scientific PI) and the Nunavik Regional Board of Health and Social Services regarding the financing of the survey follow-up. Planning activities to begin in 2014 and survey to be conducted in 2015-2016.

Objective 4: Development and submission of the following research proposals whose objectives are related to scientific activities of this project

The following research proposals were submitted, by Mylène Riva as principal investigator:

A. Surveillance des inégalités sociales de santé en milieu autochtone : documenter les déterminants sociaux de la santé aux niveaux individuels, des logements et des communautés afin de soutenir les interventions populationnelles. [Monitoring social inequalities in Aboriginal health: identifying the social determinants of Aboriginal health at the individual, household, and community levels to support population health interventions]

- Funding organization: Fonds de recherche du Québec - Santé (FRQS): Research Scholars Junior 1
- Principal applicant: Mylène Riva
- Total funding; years: \$280,890; 2014-2018
- Proposal submitted on: October 1st 2013; Notice of decision: Expected April 2014

B. Housing in the Canadian Arctic: Assessing the health impacts of rehousing for Inuit families.

- Funding organization: Canadian Institutes of Health Research (CIHR) - Population Health Intervention Research
- Principal applicant: Mylène Riva
- Total Funding: \$199,896; 2014-2016

- Proposal submitted on: December 2nd 2013; Notice of decision: Expected March 2014

Results

Related to Objective 1: Development and harmonization of the International Inuit Cohort Study

Pertaining to the development of the data depository

Creation of a summary workbook

A document was created to report in details which variables were compatible across the three datasets and what methodological procedures were used for achieving data harmonization and standardization.

Meeting

A conference call was organized between the principal investigators and collaborators of the three health surveys to discuss the issues in data harmonization and standardization. Because some challenges were encountered when harmonizing data from clinical tests and nutrient status, it had been decided to ask for support of knowledgeable persons and experts.

Participation in the 20th Anniversary Results Workshop of the Northern Contaminants Program, Ottawa; Poster presentation: Aline Philibert, Peter Bjerregaard, Eric Dewailly, Kue Young and Laurie Chan. International Inuit Cohort (ICC). International Platform for Collaborative Outcomes Research in Contaminant Exposure and Health Issues in the Inuit Circumpolar Region.

Completion of the merged dataset

The harmonization of data from the three cohort studies allows us to a myriad of information on 6777 participants covering the period 2004 to 2010 inclusive. The final data repository resulting from

Table 1. Description of the frequency of harmonized and created data by categories in the merged data

Categories of variables	Harmonized data (N)	Created data (N)	Total (N)
Socio-demographic status	10	1	11
Health history	40	0	40
Social networks	5	0	5
Lifestyle factors	16	0	16
Anthropometry	49	9	58
Food use pattern	9	0	9
Clinical biochemistry	34	24	58
Nutrient status	1	0	1
Clinical test			
Environmental contaminants	27	28	55
Total	191	62	253

the harmonization process encompasses a total of 191 cross-national data on socio-demographic characteristics, health history (chronic diseases and mental health and reproductive health), lifestyle, social networks, anthropologic and clinical information, lipids, essential elements and environmental contaminants (metals and organic compounds). Table 1 presents the variability of variables per category.

Related to Objective 2 – Analysis of data from the International Inuit Circumpolar Cohort

1. The influence of housing and community conditions on Inuit health

a) Household crowding and Inuit health

Household crowding is an important problem in some Aboriginal communities that is reaching particularly high levels among the circumpolar Inuit. As living in overcrowded conditions may endanger health via stress pathophysiology, this first study examined whether higher household crowding is associated with stress-related physiological dysregulations among Inuit. Using data from the Nunavik Inuit Health Survey, chronic stress was measured using the concept of allostatic load (AL) representing the multi-systemic biological ‘wear and tear’ of chronic stress. After controlling for participants’ age, sex, income, diet and involvement in traditional activities in regression analyses, higher household crowding was significantly associated with elevated levels of chronic stress.

A second study examined whether household crowding is associated with poorer psychosocial health among Greenlandic Inuit. It also assesses whether Inuit men and women are differently influenced by their housing conditions. Using data from the Inuit Health in Transition Greenland Survey, we observed a higher prevalence of poorer mental well-being among people living in more crowded households. Binge drinking was more common among people living in ‘adult-only’ households. Sex-stratified analyses indicated that, compared to men, women’s psychosocial health is influenced to a greater extent by household crowding.

b) Community conditions as important determinants of Inuit health

Results of multilevel analyses examining community conditions and Inuit health reported in our previous 2012-2013 report to ArticNet have been extensively revised and strengthened to focus on social and geographic inequalities associated specifically with high blood pressure. Results show that adjusting for age, sex and known risk factors for hypertension, blood pressure is higher among people with lower household wealth and in communities with lower average disposable household income.

2. Environmental contaminants exposure and atherosclerosis and hypertension in Inuit populations

a) Mercury

An increasing number of studies suggest that chronic methylmercury (MeHg) exposure may increase the risk of cardiovascular diseases (CVD) such as atherosclerosis. Using data from the IPY-IHS and Nunavik Inuit Health Study, we examined whether such effect was present among Canadian Inuit.

Blood mercury was associated with an increase in carotid intima-media thickness (CIMT), a proxy marker of atherosclerosis, adjusting for classical cardiovascular risk factors, among participants in

the IPY-IHS study. However, for participants in Nunavik, the association between blood mercury and atherosclerosis was not significant.

b) Persistent Organic Pollutants (POPs)

Results showed important variations in blood level concentrations of environmental POPs between the Nunavik and IPY-IHS cohorts. This could reflect differences in lifestyles (e.g. diet), environmental contamination across different regions of the Canadian Arctic, and/or measurements of contaminants at different time periods (2004 versus 2007-2008).

Results from the IPY-IHS cohort showed a positive and significant association between plasma concentrations of POPs mixture and CIMT. However, when adjusting the analysis by regions the strength of the association between POPs mixture and CIMT, and its significance, was reduced, but remained significant. More research is needed to clarify if some local characteristics could explain regional variations.

Among participants in Nunavik, the association between POPs mixture and CIMT was not significant after adjustments, despite generally higher levels of POPs and contaminants concentrations compared to participants of the IPY-IHS cohort. These results could be explained by a lack of statistical power, as the sample was small, and by a really strong effect of age as a predictive and confounding factor in this sample. In fact, in both cohorts, age predicted nearly 30% of CIMT and the concentrations of POPs seemed to be more correlated with age in Nunavik than in other Inuit regions in Canada.

In Greenland, hypertension was not statistically associated with POPs (i.e. PCBs, non-dioxin-like PCBs and organochlorine (OC) pesticides) after adjusting for confounders in the overall sample. However, results varied by age groups. Once the analyses were stratified by age category (18–39 and ≥ 40 years), increased risk of hypertension was observed for total dioxin-like PCBs among the youngest while a borderline protective effect was

observed for total non-dioxin-like PCBs among the oldest. Higher risk of hypertension was also associated with increasing DDT concentrations among the youngest age group.

Related to objective 3: Prepare the follow-up to the baseline Nunavik Inuit Health Survey

None to report for 2013-14.

Related to objective 4: Development and submission of the following research proposals whose objectives are related to scientific activities of this project

Notification of decisions regarding the two projects submitted for funding will be announced in March and April 2014.

Discussion

Related to objective 1: Development and harmonization of the International Inuit Cohort Study

The harmonization of data from the three cohort studies to form the IICS allows for a range of health-related issues to be investigated among the circumpolar Inuit. These will be the topic of analyses in 2014.

Related to objective 2: Data analyses of the IICS

Housing conditions are a critical public health issue in the circumpolar Arctic, associated with increased levels of stress and with poorer mental well-being. Findings suggest that public health initiatives targeting housing conditions might be a key strategy to improve health in the Arctic. Toward this end, housing conditions and their impacts on people's health and well-being should be investigated further to inform healthy and sustainable housing strategies. The observation that community conditions, such as higher levels of deprivation, are associated with a higher

blood pressure; adjusting for known risk factors, further suggest that public health and social policies, programs and interventions targeting communities might yield population-wide health benefits. To our knowledge, this is the first study that examined community-level determinants of blood pressure among Inuit, but also more broadly among Indigenous populations, using a multilevel empirical framework.

The effect of contaminants on cardiovascular diseases and risk factors are demonstrated by results of our studies among Canadian and Greenlandic Inuit. Mercury contamination among the Canadian Inuit populations (due to consumption of fish and marine mammals) resulted in a large variation in blood mercury levels. Subclinical atherosclerosis described through CIMT percentiles showed differences in evolution between the populations studied, for the same age and sex distribution. By using categories of CVD risk based on CIMT quantiles independent of age and sex (the two most important predictors of the CIMT), we were able to explore more subtle effects of other risk factors such as potential role of other environmental contaminants. Among the IPY-HIS sample only, subclinical atherosclerosis progression (associated to an increasing risk of CVD) could be related to mercury exposure with half the concentration of blood mercury considered at a 'no risk' level (Health Canada). Chronic mercury exposure may increase CVD at non 'toxic' dose. In the Nunavik sample, a lack of power could explain our non-significant results. Moreover because of high levels of blood mercury in all CVD risk categories in this population, differences could also be really hard to distinguish.

Circulating POPs are thought to be involved in the observed increase in risk factors for cardiovascular diseases (CVD) such as hypertension, obesity, metabolic syndrome and diabetes. POPs have also been related to history of CVD such as myocardial infarction, stroke and atherosclerosis. Results of our studies examining association between POPs and atherosclerosis and hypertension among the circumpolar Inuit contribute to this body of evidence.

Related to objectives 3 and 4

(Data to be collected.)

Conclusion

Related to objective 1: Development and harmonization of the International Inuit Cohort Study

It is hoped that the development of the data platform from harmonization across heterogeneous cohort studies will serve as a model for other regions. The data platform will facilitate knowledge to action and the development of regional and international policies to promote health.

Related to objective 2: Data analyses of the IICS

Results from studies examining the influence of housing and community conditions on health point to the role of more meso and macro socio-environmental factors in explaining the higher prevalence of poorer health status among the Inuit. Reducing household crowding, through housing policies, is likely a key strategy to improve Inuit health and well-being. To better inform the formulation of housing policies, more research is needed to understand the pathways through which housing conditions "get under the skin" to influence Inuit health and well-being. As well, more research is needed to conceptualize and operationalize housing and community conditions that are relevant for health and in coherence with the Inuit culture. These issues will be addressed in the two projects submitted for funding.

Association between mercury and/or POPs exposure and increasing progression of atherosclerosis and hypertension have been demonstrated among the circumpolar Inuit, although the pattern of association is complex, notably between different age groups. More research is needed, including cohort and experimental studies, to further explore and confirm these results and to identify the mechanisms involved in explaining the observed associations.

Related to objectives 3 and 4

(Data to be collected.)

Acknowledgements and References

The three health surveys which form the basis of the Circumpolar Inuit Cohort were made possible by a large number of organizations and individuals, including (but not an exhaustive list): the IPY Program, Government of Canada, Government of Nunavut, AANDC, Health Canada, University of Toronto, CIHR, Government of Greenland, Institut national de santé publique de Québec, Nunavik Regional Board of Health and Social Services, Ministère de santé et services sociaux, and ArcticNet.

Publications

(All ArcticNet refereed publications are available on the ASTIS website (<http://www.aina.ucalgary.ca/arcticnet/>).

Bjerregaard, P., Pedersen, HS., Nielsen, NO., Dewailly, E., 2013, Population surveys in Greenland 1993-2009: temporal trend of PCBs and pesticides in the general Inuit population by age and urbanisation, *Sci Total Environ*, 454-455, 283-288

Paunescu, AC., Ayotte, P., Dewailly, E., Dodin, S., 2013, Dioxin-like compounds are not associated with bone strength measured by ultrasonography in Inuit women from Nunavik (Canada): results of a cross-sectional study., *Int J Circumpolar Health*. 29;72, 20843

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Riva, M., Lytken Larsen, C.V., Bjerregaard, P., 2013, Household crowding and psychosocial health among

Greenlandic Inuit., *International Journal of Public Health*. Under review,

Riva, M., Plusquellec, P., Juster, R.P., Laouan-Sidi, E.A., Abdous, B., Lucas, M., Déry, S., Dewailly, E., 2014, Household crowding is associated with higher allostatic load among Inuit., *Journal of Epidemiology and Community Health*., doi:10.1136/jech-2013-203270

Rudkowska I, Ouellette C, Dewailly E, Hegele RA, Boiteau V, Dubé-Linteau A, Abdous B, Proust F, Giguère Y, Julien P, Château-Degat ML, Vohl MC., 2013, Omega-3 fatty acids, polymorphisms and lipid related cardiovascular disease risk factors in the Inuit population., *Nutr Metab*, 12;10, 26

Valera B, Jørgensen ME, Jeppesen C, Bjerregaard P., 2013, Exposure to persistent organic pollutants and risk of hypertension among Inuit from Greenland., *Environmental Research*, 122, 65–73