Examining Factors Contributing to Hypothyroidism: Canadian Longitudinal Study on Aging

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The Healthy Immigrant Effect

- Recent immigrants often arrive healthier than native-born populations
- Health advantage declines with time in host country
- Observed across Canada, U.S., UK, Australia[1-3]

1. Kennedy, S., Kidd, M.P., McDonald, J.T. et al. The healthy immigrant effect: Patterns and evidence from four countries. Int. Migration & Integration 16, 317–332 (2015).
2. Newbold B. The short-term health of Canada's new immigrant arrivals: Evidence from LSIC. Ethn Health. 2009;14(3):315-336.
3. Vang ZM, Sigouin J, Flenon A, Gagnon A. Are immigrants healthier than native-born Canadians? A systematic review of the healthy immigrant effect in Canada. Ethn Health. 2017;22(3):209-241.
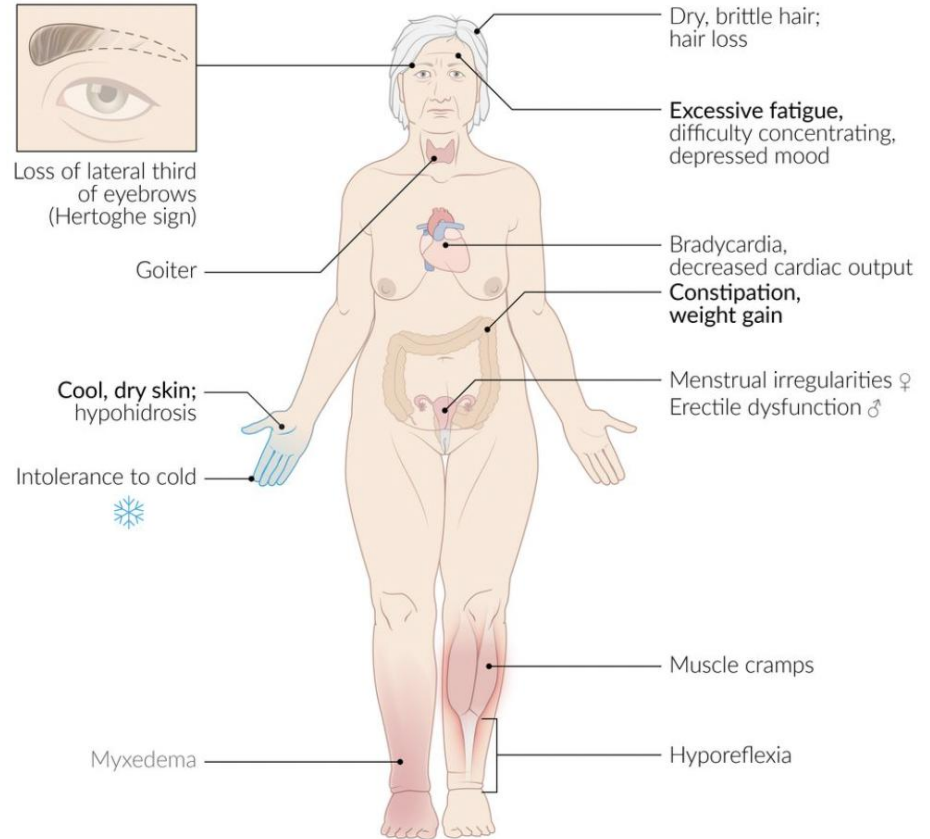
Hypothyroidism: Why It Matters

What is hypothyroidism?
- Insufficient thyroid hormone production
- Prevalence ≈ 10–12% in adults

Risk factors:
- Older age
- Female sex
- Nutrition
- Smoking
- Obesity
- Stress

Dry, brittle hair; hair loss

Excessive fatigue, difficulty concentrating, depressed mood

Bradycardia, decreased cardiac output

Constipation, weight gain

Menstrual irregularities ♀
Erectile dysfunction ♂

Muscle cramps

Hyporeflexia

Loss of lateral third of eyebrows (Hertoghe sign)

Goiter

Cool, dry skin; hypohidrosis

Intolerance to cold ❄

Myxedema

Why Study Hypothyroidism in Immigrants?

- Symptoms may be
   overlooked or normalized
- Language barriers
- Disparities in access to preventive care
- Lower screening rates among immigrants[4]

4. Stoll K. Disparities in thyroid screening and medication use in Quebec, Canada. Health Equity. 2019;3(1):328-335a

- Project started when in role of Canada Research Chair (Nutrition Informatics - 2021-2022)
- Continued on project as an affiliate of the University of Toronto
- Current work: data analyzer, educator, dietetics consultations (clinical focus)

Disclosures:

Team Member Acknowledgement: Michelle Carter, MA, Andie MacNeil Ma, MSW

Our Mentor: Dr. Esme Fuller-Thomson, Institute for Life Course & Aging, Factor-Inwentash Faculty of Social Work, University of Toronto

Purpose and Objectives

Purpose:
Examine relationships among immigration status, cultural or racial background, and hypothyroidism

Objective 1:
Compare prevalence estimates and odds of hypothyroidism among domestic-born middle-age and older adults, recent immigrants (<20 yrs), and longer-term immigrants (20+ yrs)

Objective 2:
Compare prevalence estimates and odds of hypothyroidism among immigrants' cultural/racial background compared to Canadian-born peers of all races
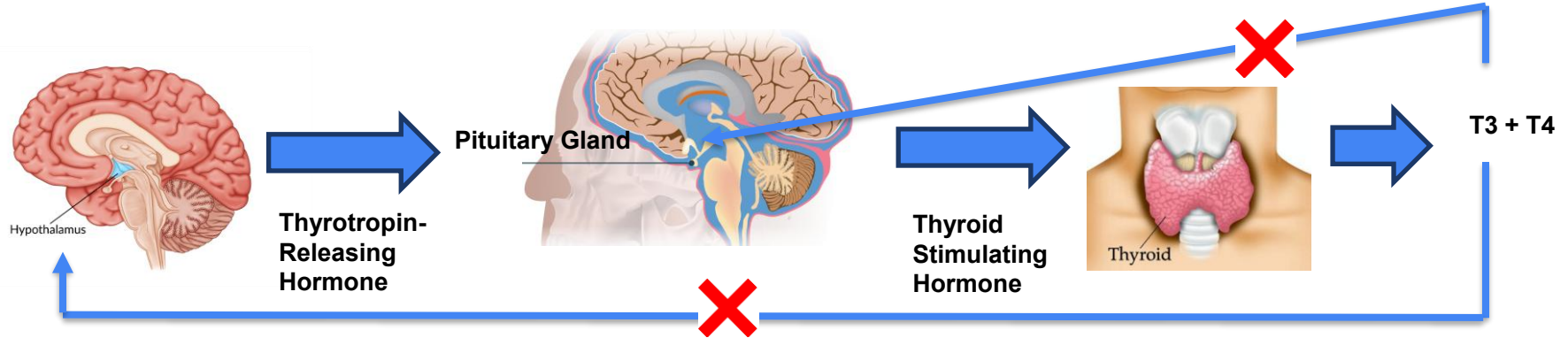
Objective 3:
Examine associations between sociodemographic, health, and nutrition-related factors and hypothyroidism

Methods: Sample

- Derived from baseline weighted data of Comprehensive cohort (n=30,097)
- 27,170 (90.3%) provided blood samples (TSH and T4); those with hyperthyroidism were excluded
- Final sample: 26,036 with valid data on all variables (unweighted)

Dependent Variable: Hypothyroidism

Pituitary Gland

Hypothalamus

Thyrotropin-Releasing Hormone

Thyroid Stimulating Hormone

Thyroid

T3 + T4

Measure: blood levels of TSH and T4 plus those taking thyroid hormone medication

Blood test results classified as:

- TSH levels between 0.41 and 4.9 mIU/L = no hypothyroidism
- TSH levels < 0.41 mIU/L → T4 levels cross-referenced to ascertain definite hyperthyroidism
- T4 levels < 27.0 pmol/L = definite hypothyroidism
- TSH levels ≥ 5.0 mIU/L & T4 levels 27 and 51 pmol/L = subclinical hypothyroidism

3,119 with no blood thyroid levels → excluded unless they were taking thyroid hormones

Hypothyroidism included: definite or subclinical. Definite hyperthyroidism (T4 levels > 51.0 pmol/L) excluded

Independent Variables:
Immigration Status & Cultural/Racial Origin of Immigrants

Immigration Status:

Canadian born, immigrant in Canada <20 years and immigrant in Canada ≥ 20 years

Immigrants' Identified Cultural or Racial Background:

Response to statement: "*People living in Canada come from many different cultural and racial backgrounds*." Followed by list of responses such as:

➤ White
➤ Chinese
➤ South Asian (e.g., East Indian, Pakistani, Sri Lankan)
➤ Black, Filipino, Latin American

➤ Southeast Asian (e.g., Cambodian, Indonesian, Laotian, Vietnamese)
➤ Arab
➤ West Asian (e.g., Afghan, Iranian)
➤ Other immigrant groups

Covariates

1. Demographic, Social, and Economic Measures

Variable Name	Definition
Gender	Men or women
Age	1) 45-55 2) 56-65 3) 66-75 4) 76-85 yrs
Income	Estimated gross household income/past 12 months: 1) <$20,000 2) $20,000- < $50,000 3) $50,000- <$100,000 4) $100,000-<$150,000 5) >$150,000 6) no response
Relationship Status	1) single 2) married/live with partner/common-law 3) widowed/divorced/ separated
Education	1) <secondary school graduate 2) high school graduate &/or with some post-secondary education 3) post-secondary degree/diploma 4) non-response

Covariates /cont'd

2. Health Measures

Variable Name	Definition
Multi-morbidity°	Categories: 1) no health conditions; 2) 1 health condition; 3) 2 health conditions; 4) ≥3 health conditions
Blood Pressure	Am. College of Cardiology Guidelines; avg results: 1) normal (syst. <120 mm Hg; diast. <80 mm Hg); 2) elevated HT (syst. 120-129 mm Hg; diast. <80 mm Hg); 3) stage one HT (syst. 130-139 mm Hg; diast. 80-89 mm Hg); 4) stage two HT (syst. ≥ 140 mm Hg or diast. ≥ 90 mm Hg); 5) currently taking anti-HT medication
Chronic and Debilitating Pain	Based on two questions that asked if were usually free from discomfort (yes/no) and # of activities that their pain/discomfort prevented (none, few, some, most). Categories: 1) No chronic pain or no activities restricted by pain; 2) A few, some or most activities prevented by pain; and 3) Not assessed.
Lifetime Smoking	Two categories based on whether participants reported if they ever smoked at least 100 tobacco cigarettes in their lifetime or not
Physical Activity	Based on Physical Activity Scale for the Elderly (PASE) question about average time/day engaged in light sports or recreational activities: 1) <30 minutes; 2) 30-59 minutes; 3) 1 or more hours; 4) no response.

°sum of chronic condition diagnoses: diabetes (type I, II, borderline), COPD, chronic bronchitis, or changes in lungs d/t smoking, CVD or CHF, PVD or poor circulation in limbs, dementia or Alzheimer's disease, multiple sclerosis, epilepsy, migraines, intestinal or stomach ulcers, bowel disorders (e.g., Crohn's disease, ulcerative colitis, IBS), macular degeneration, anxiety disorder, mood disorder, back problems (excluding fibromyalgia), kidney disease or kidney failure, RA, OA (hands, hip or knee), cancer (all types excluding thyroid cancer), TBI

Covariates /cont'd

2. Health Measures /cont'd

Variable Name	Definition
Drinking Behaviour	Reported frequency of drinking alcohol: 1) never/past month; 2) 2-3 times/ month or about once/month or < once/month; 3) almost every day, 4-5 times/wk, 2-3 times/week or once/wk
Disease Risk	BMI and waist to hip ratio: 1) very high risk; 2) least risk; 3) increased risk; 4) high risk
Handgrip Strength	Tracker Freedom wireless grip dynamometer: 1) under-nutrition (19.2 kgf (kilogram force) (women); 37.9 kgf (men) 45-64 yrs or 30.2 kgf (men & women) 65 yrs[+]; 2) no under-nutrition; 3) not assessed
Bone Density	Measured by dual energy x-ray absorptiometry (DEXA). Categories: 1) normal (T-score > -1); 2) osteoporosis (T-score ≤ -2.5) or osteopenia (T-score -1 to -2.5); 3) Not assessed
Nutritional Risk	Based on modified SCREEN© II instrument (Seniors in the Community: Risk Evaluation for Eating and Nutrition). Categories: 1) high risk (<38); 2) low risk (≥38); 3) not assessed

Covariates /cont'd

3. Dietary Intake Measures

Variable Name	Definition
Fibre Intake	High fibre breakfast cereals, whole wheat, bran, multigrain, and rye breads averaged on a daily basis. Categories: <1 source/d, ≥1 & <2 sources/d; ≥2 sources/d
Pulses and Nuts	Legumes (beans, peas, lentils), nuts, seeds and peanut butter averaged on a daily basis (<0.5 vs ≥0.5 sources/d)
Fat Sources	French fries/pan-fried potatoes, poutine; butter/margarine on bread/cooked vegetables only; regular vinaigrettes, salad dressings, mayonnaise, homemade/commercial dips; beef, pork; other meats (veal, lamb, game); patés, cretons, terrines; sauces & gravies; sausages, hot dogs, ham, smoked meat, bacon; all egg dishes except omega-3 eggs; chicken, turkey. Categories: <2.5 sources/d; ≥2.5 & <4 sources/d; ≥4 & <5 sources/d; and ≥5 sources/d
Omega-3 fatty acid sources	Average consumption of omega-3 eggs and fish (≤1 vs >1 sources/d)

Covariates /cont'd

3. Dietary Intake Measures /cont'd

Variable Name	Definition
Fruits and Vegetables	Fresh, frozen, or canned fruits, green salad, potatoes, carrots and other vegetables averaged on a daily basis. Subdivided as: <2 sources/d; ≥2 & <6 sources/d; and ≥6 sources/d
Sweets	Pastries (e.g., cakes, pies, doughnuts, pastries, cookies, muffins); <0.25 vs ≥ 0.25 sources/d
Calcium Sources	Calcium-containing food sources: calcium-fortified milk (35% more calcium), milk (3.25%, 2%, 1%, m.f.), low-fat/regular cheeses; milk-based desserts; calcium-fortified bvgs/juices/foods, yogurt. Categories: <1; ≥1 to <2; ≥2 to <3; ≥3 to <4; ≥4 sources/d
Salty Snacks	Consumption of salty snacks (e.g., regular chips, crackers). Categories: <0.25; ≥0.25 to <1; ≥1 sources/d

Sources:
Whelton et al. 2017 ACC, AHA, AAPA, ABC, ACPM, AGS, APhA, ASH, ASPC, NMA, PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults: Executive Summary: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. Hypertension, 71(6), 1269-1324. doi:10.1161/HYP.0000000000000066.
Logan et al. The Physical Activity Scale for the Elderly (PASE) questionnaire; does it predict physical health? Int J Environ Res Public Health. 2013 Aug 30;10(9):3967-86. doi: 10.3390/ijerph10093967.
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Guerra et al. 2014. Handgrip strength cutoff values for undernutrition screening at hospital admission. Eur J Clin Nutr. 68(12), 1315. doi: 10.1038/ejcn.2014.226
WHO, 2011a. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. Vitamin and Mineral Nutrition Information System. Geneva, World Health Organization, 2011 (WHO/NMH/NHD/MNM/11.1). http://www.who.int/vmnis/indicators/haemoglobin.pdf.
Shatenstein et al., 2015. Evaluation of the relative validity of the short diet questionnaire for assessing usual consumption frequencies of selected nutrients and foods. Nutrients. 7(8), 6362-6374. doi:10.3390/nu7085282

Method: Analysis

1. Analyses (weighted data) completed in IBM SPSS **Version 22**

2. Normalized trimmed inflation weights applied:

$$\frac{\text{Trimmed inflation weight of each unit used in analysis}}{\text{Average of the survey weights of all the analyzed units}}$$

3. Binary logistic regression two models were assessed:

    i) immigration status as main independent variable; and

    ii) cultural or racial background of the immigrants as main independent variable

- Interaction term: sex X immigration status generated & assessed in regression analyses
- Model fit diagnostics applied (e.g., collinearity check, log-likelihoods)

Results: Description of Sample

1,953/26,036 (7.5%) had hypothyroidism

Most:
- born in Canada (81.3 %)
- 55 years+ (60.6 %)
- annual household incomes >$50,000 (67.7 %)
- in relationship (75.4 %)
- some post-secondary education (62.5 %)

Results: Distribution of Independent Variables

1. Immigration Status (filtered sample)

Description	% in sample, weighted	% with hypo-thyroidism, weighted
Born in Canada	81.3	6.6
Immigrated < 20 yrs ago	2.9	3.7
Immigrated ≥ 20 yrs ago	15.8	7.7

2. Immigration Status (filtered sample)

Description	% in sample, weighted	% with hypo-thyroidism, weighted
Born in Canada	81.3	6.6
White immigrants	13.6	6.9
Chinese immigrants	0.6	5.8
South Asian immigrants	1.1	9.9
Black immigrants	1.0	7.4

Description	% in sample, weighted	% with hypo-thyroidism, weighted
Latin American immigrants	0.5	6.7
SE Asian immigrants	13.6	6.9
Arabian & West Asian immigrants	0.6	5.8
Other immigrants	1.1	9.9

Results: Binary Logistic Regression

1. Immigration Status:

Description	Unadjusted OR	Adjusted OR
Born in Canada	1	1
Immigrant < 20 yrs	**0.53 (0.36–0.78, *p* = 0.001)**	**0.62 (0.42–0.93, *p* = 0.019)**
Immigrant ≥ 20 yrs	**1.17 (1.03–1.34, *p* = 0.015)**	**1.11 (0.97–1.27, *p* = 0.130)**

Significant Covariates (adjusted ORs)

Description	Ref. Category	Description, Adjusted OR, 95% CI, p-value
Women	Men	1.84 (1.60–2.12, *p* < 0.001)
Age	45-55 yrs	All groups: range 1.19-1.60 (all p's < 0.05)
Single/never married or lived with a partner	Married/living w/ partner/CL	1.40 (1.16–1.69, *p* < 0.001)
Post-secondary degree/diploma	High school graduate and/or with some post-secondary	1.17 (1.03–1.34, p = 0.017)
Multimorbidity	No health condition	One condition = 1.21 (1.03–1.42, *p* = 0.018) & ≥ 3 conditions = 1.24 (1.06–1.45, *p* = 0.006)
Blood pressure	< 120 (syst.) & 80 mm Hg (diast.)	Stage 2 HT or take anti-hypertensive: ORs 1.19-1.34 (p's<0.05)
Chronic & debilitating pain	No chronic pain/activities restricted by pain	Not assessed: 2.05 (1.25-3.35, p=0.004)
Alcohol consumption	Never in past year	Drink 1-3 x/m or < once/m: 0.43 (0.24–0.77, *p* = 0.004)
Disease risk	Least risk	Very high disease risk: 1.23 (1.07–1.42, *p* = 0.003)

Results: Binary Logistic Regression /cont'd

1. Immigration Status /cont'd

Significant Covariates (adjusted ORs) /cont'd

Description	Ref. Category	Adjusted OR, 95% CI, p-value
Grip strength	No undernutrition	Grip strength (not assessed): 1.31 (1.08–1.59, p = 0.007)
Bone density	Osteoporosis or osteopenia	Normal bone density: 0.85 (0.75–0.98, p = 0.021)
Nutrition risk	No risk	High Nutrition risk: 1.13 (1.01–1.27, p = 0.029)
Average pulses/nuts intake	< 0.5 sources/d	≥ 0.5 sources/d: 0.88 (0.79–0.98, p = 0.023)
Average fat intake	≥ 5 sources/d	intake 2.5- <5 sources/d: ORs 0.71-0.75 (p's<0.05)
Average omega-3 fatty acid intake	< 1/d	≥ 1/d: 0.65 (0.46–0.91, p = 0.011)
Average vegetables & fruit	≤ 2/d	≥ 6/d: 0.73 (0.58–0.91, p = 0.006)
Average calcium intake	≥ 2 to < 3 sources/d	<2 or ≥ 3 to < 4/d: ORs 1.21-1.44 (p's <0.05)

Results: Binary Logistic Regression /cont'd

2. Cultural/Racial Background:

Description	Unadjusted OR	Adjusted OR
Born in Canada (ref)	1	1
White immigrants	1.04 (0.90–1.20, $p = 0.581$)	0.98 (0.85–1.14, $p = 0.816$)
Chinese immigrants	0.86 (0.44–1.70, $p = 0.670$)	0.99 (0.50–1.97, $p = 0.976$)
South Asian immigrants	**1.54 (1.01–2.29, $p = 0.030$)**	**1.77 (1.18–2.66, $p = 0.006$)**
Black immigrants	1.15 (0.72–1.83, $p = 0.557$)	1.06 (0.66–1.72, $p = 0.806$)
Latin American immigrants	1.03 (0.53–2.02, $p = 0.931$)	1.18 (0.60–2.34, $p = 0.636$)
Southeast Asian immigrants	1.31 (0.68–2.52, $p = 0.424$)	1.22 (0.62–2.41, $p = 0.563$)
Arabian and West Asian immigrants	0.79 (0.41–1.53, $p = 0.486$)	1.06 (0.54–2.06, $p = 0.874$)
Other immigrants	1.11 (0.61–2.02, $p = 0.738$)	1.17 (0.64–2.17, $p = 0.610$)

Results: Binary Logistic Regression /cont'd

2. Cultural/Racial Background /cont'd:

Significant Covariates (adjusted ORs)

Description	Ref. Category	Description, Adjusted OR, 95% CI, p-value
Women	Men	1.83 (1.59–2.11, p < 0.001)
Age	45-55 yrs	All groups: range 1.24-1.69 (all p's < 0.05)
Single/never married or lived with a partner	Married/living w/ partner/CL	1.43 (1.19–1.72, p < 0.001)
Post-secondary degree/diploma	High school graduate and/or with some post-secondary	1.16 (1.02–1.32, p = 0.027)
Multimorbidity	No health condition	One condition = 1.20 (1.03–1.41, p = 0.022) & ≥ 3 conditions = 1.26 (1.07–1.47, p = 0.004)
Blood pressure	< 120 (syst.) & 80 mm Hg (diast.)	Stage 2 HT or take anti-hypertensive: ORs 1.19-1.35 (p's<0.05)
Chronic & debilitating pain	No chronic pain/activities restricted by pain	Not assessed: 2.08 (1.27-3.41, p=0.004)
Alcohol consumption	Never in past year	Drink 1-3 x/m or < once/m: 0.45 (0.25–0.79, p = 0.006)
Disease risk	Least risk	Very high disease risk: 1.23 (1.07–1.42, p = 0.003)

Results: Binary Logistic Regression /cont'd

2. Cultural/Racial Background cont'd:

Significant Covariates (adjusted ORs) /cont'd

Description	Ref. Category	Adjusted OR, 95% CI, p-value
Grip strength	No undernutrition	Grip strength (not assessed): 1.33 (1.10–1.62, p = 0.004)
Bone density	Osteoporosis or osteopenia	Normal bone density: 0.86 (0.75–0.98, p = 0.023)
Nutrition risk	No risk	High risk: 1.13 (1.01–1.26, p = 0.039)
Average pulses/nuts intake	< 0.5 sources/d	≥ 0.5 sources/d: 0.88 (0.79–0.99, p = 0.031)
Average fat intake	≥ 5 sources/d	intake 2.5- <5 sources/d: ORs 0.72-0.77 (p's<0.05)
Average omega-3 fatty acid intake	< 1/d	≥ 1/d: 0.65 (0.47–0.91, p = 0.012)
Average vegetables & fruit	≤ 2/d	≥ 6/d: 0.73 (0.58–0.91, p = 0.006)
Average calcium intake	≥ 2 to < 3 sources/d	<2 or ≥ 3 to < 4/d: ORs 1.21-1.44 (p's <0.05)

Key Findings: Hypothyroidism by Immigration Status

- **Recent immigrants (<20 years):**
  - Significantly lower odds of hypothyroidism
  - OR 0.62 (95% CI 0.42–0.93)
- **Long-term immigrants (≥20 years):**
  - Similar odds to Canadian-born

Key Findings: Hypothyroidism by Cultural/Racial Backgrounds

- **South Asian immigrants:**
  - Higher odds of hypothyroidism
  - OR 1.77 (95% CI 1.18-2.66) vs. Canadian-Born Individuals
- Other immigrant groups:
  - No statistically significant differences observed

Key Findings: Hypothyroidism by Nutrition

Lower odds associated with:
- Higher omega-3 intake
- ≥6 fruit & vegetable servings/day
- Greater pulses and nuts intake

Higher odds associated with:
- ≥5 sources of fat/day
- Suboptimal calcium intake patterns

Relevance to Family Medicine

Family physicians are uniquely positioned in:

- Primary preventative care and risk-based screening
- Provide culturally sensitive counseling
- Advocate for patients by addressing social and cultural barriers
- Coordinate timely evaluation and referral

Practice Implications

- Consider **lower threshold for TSH testing** in:
  - Older adults (especially ≥75)
  - Patients of South Asian descent
    - Particularly when symptoms are vague or multifactorial
- Encourage lifestyle interventions:
  - Fruits and vegetables
  - Omega-3 sources
  - Pulses and nuts

Take Home Messages

- Healthy Immigrant Effect applies to hypothyroidism
- Risk equalizes with time in Canada
- South Asian immigrants have higher odds of hypothyroidism
- Nutrition matters
- Family Medicine can close screening gaps

Limitations

- Definition of hypothyroidism included self-reports of medication use

- Lacking information on respondents' level of healthcare utilization: query if true hypothyroidism might be under-diagnosed/reported. To minimize this limitation, T4 and TSH levels were also examined to determine hypothyroid status

- Did not include information on individuals' class of immigration (e.g., refugee status). Refugees may be more likely to encounter pre-migration stressors, mental health conditions, and higher rates of infectious and chronic communicable and non-communicable disease

- Small sample size of certain cohorts (e.g., those who immigrated less than twenty years ago, different ethnic/racial groups of immigrants): lower statistical power which decreases the likelihood of achieving statistical significance

- Unable to examine different White immigrant groups and the relationship to hypothyroidism

Next Steps with Research About Hypothyroidism

- Hypothyroidism common among women 50 years+ and appears to have increasing trends

- Hypothesis: Increased intake of ultra-processed foods (tend to lack iodine) may be contributing to increasing hypothyroidism trends in this demographic

- Approach: Examine urinary iodine concentrations in relation to hypothyroidism

Thank You to the Canadian Longitudinal Study on Aging administration for inviting us to present

Thank you for listening

Questions?

Questions later? Contact: Dr. Esme Fuller-Thomson (esme.fuller.Thomson@utoronto.ca)