



Full length article

Skewed distribution of hypothyroidism in the coastal communities of Newfoundland, Canada

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ABSTRACT

Several studies published in the recent past have shown that rising levels of thyroid disrupting chemicals (TDCs) in the environment affect thyroid function in humans. These TDCs are the anthropogenic organic compounds that enter the human body mostly by ingestion and may trigger autoimmune thyroiditis, the most common cause of hypothyroidism. The studies also show the presence of high levels of TDCs in marine animals; therefore, consumption of contaminated seafood might trigger hypothyroidism. So far, there is no readily available population-based data, showing the regional distribution of hypothyroidism cases. We collected administrative data from the Newfoundland and Labrador Centre for Health Information on hospitalizations with hypothyroidism (from 1998 to 2012) in 41 coastal communities of Newfoundland and found that mean hypothyroidism rates of west and south coasts were significantly higher than in the east coast (1.8 and 1.9 times respectively). A one-way analysis of variance was used to test for regional differences in rates. A significant between-group difference in the rate of hypothyroidism was found ($F_{2,38} = 8.309$; $p = 0.001$). The St. Lawrence River, its estuary and the Gulf of St. Lawrence are heavily polluted with TDCs from industries, their effluents, and urbanization in the Great Lakes Watershed and along the river. Environment Canada has already identified this river along with the Great Lakes Watershed as one of the top TDCs polluted water sources in the country. The west and south coasts are in contact with the Gulf of St. Lawrence. Local marine products are a regular diet of the coastal communities of Newfoundland. Based on these available evidence, we hypothesize the role of TDCs in the rise of hypothyroidism on the western and southern coasts. However, further study will be needed to establish any association between abnormally high rates of hypothyroidism and exposure to TDCs.

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1. Introduction

Hypothyroidism is the most common thyroid disorder in North America; women are more likely to develop the disease than men. The National Health and Nutrition Examination Survey (NHANES) III showed that 4.3% of population (12 year and above) living in the USA had sub-clinical or mild hypothyroidism and 0.3% had clinically significant or overt hypothyroidism (Adler and Burman, 2009). The most common type of hypothyroidism is Hashimoto's thyroiditis, an autoimmune disorder that gradually destroys the thyroid gland (Brent and Davies, 2011; NEMDIS, 2013). However, several studies published in recent years have shown that rising levels of chemical pollutants affect thyroid function in humans. These thyroid disrupting chemicals (TDCs) are essentially organic compounds released into the environment through a

variety of human activities, including industrial processes, agricultural activities, incinerators and urban waste (Boas et al., 2006). TDCs may trigger autoimmune thyroiditis and mimic thyroid hormone action by modulating the binding of these hormones to their receptors, potentially leading to thyroid functional disorders (Burek and Talor, 2009; Chauhan et al., 2000; Zaletel and Gaberscek, 2011). For example; polyaromatic hydrocarbons, polychlorinated biphenyls (PCBs) or polybrominated biphenyls (PBBs), are believed to elevate anti-microsomal thyroid antibodies and anti-thyroglobulin antibodies resulting in hypothyroidism (Burek and Talor, 2009; Zaletel and Gaberscek, 2011). Thus, TDCs could contribute to lowered production and circulation of thyroid hormones, resulting in hypothyroidism (Chauhan et al., 2000).

There are very few reports on the extent of thyroid disease in Newfoundland and Labrador. Wolstenholme (1984) demonstrated a clustering of hypothyroid patients in a rural, isolated fishing community. All 251 individuals living in the village of Rencontre East (southern coast of Newfoundland) were tested for thyroid function. Fifteen individuals, all women over the age of 15, representing 16% of the female population, had thyroid hormone abnormalities. Of these, nine women had hypothyroidism, two had thyrotoxicosis and 1 had follicular adenoma, and 3 had thyroid microsomal antibodies without any abnormality of

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thyroid function. Another study conducted in 1977 identified a Newfoundland family consisting of 98 members with seven members over three generations. Eleven members in this cohort had Grave's disease; susceptibility to the disease appeared to be inherited and linked to HLA homozygosity (Farid et al., 1977). In neither study was the possibility of TDCs as an additional risk factor in the disruption of thyroid function considered. No conclusions could be drawn about the extent of thyroid disease in the entire island population (nearly half a million) because the sample size was so small. Despite substantial evidence showing that TDCs may be implicated in hypothyroidism, a causal relationship remains to be acknowledged in mainstream clinical discourse (Brent and Davies, 2011; NEMDIS, 2013). We were interested in finding out if there are regional variations in rates of hypothyroidism across Newfoundland. Furthermore, we wanted to know whether this

distribution pattern coincided with what is known about the presence of TDCs in these regions.

2. Methods

2.1. Geographic description

Newfoundland and Labrador is the most easterly province of Canada, situated in the Atlantic region. The island portion of the province, Newfoundland, is roughly triangular (west, south and east shores) in shape, with each side being approximately 400 km. The island and its associated small islands have a total area of 111,390 km² and majority of the population (90%) live along the coast (Irvine, 2012).

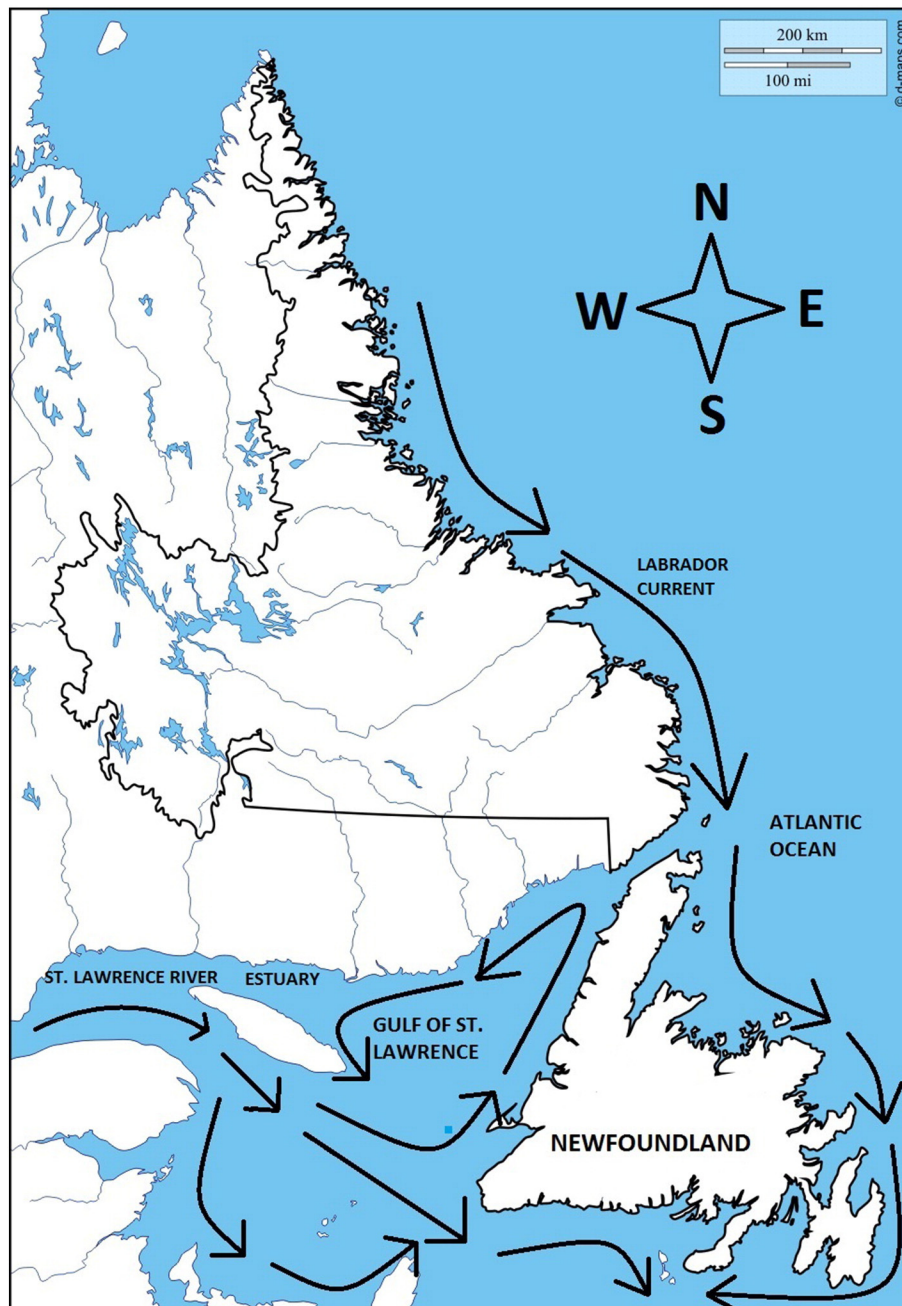


Fig. 1. Ocean currents around the island of Newfoundland.

Adapted from Canada Coast Guard (2012). Map courtesy — http://d-maps.com/carte.php?num_car=23422&lang=en.

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