Science of the Total Environment 618 (2018) 369–378

Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

How are perceptions associated with water consumption in Canadian Inuit? A cross-sectional survey in Rigolet, Labrador

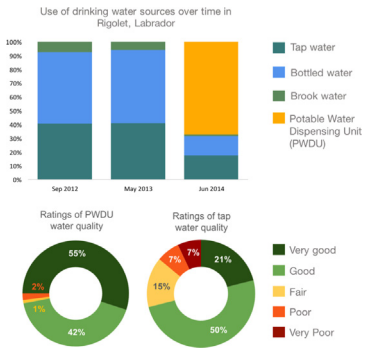
Carlee J. Wright [a,*], Jan M. Sargeant [a,b], Victoria L. Edge [c,1], James D. Ford [d,1], Khosrow Farahbakhsh [e], Inez Shiwak [f], Charlie Flowers [f], Allan C. Gordon [e], RICG [f] IHACC Research Team [1], Sherilee L. Harper [a,**,1]

[a] Department of Population Medicine, University of Guelph, 50 Stone Road East, Guelph, ON N1G 2W1, Canada
[b] Centre for Public Health and Zoonoses, Ontario Veterinary College, University of Guelph, Guelph, ON N1G 2W1, Canada
[c] Public Health Agency of Canada, 160 Research Lane, Guelph, Ontario N1G 5B2, Canada
[d] Priestley International Centre for Climate, University of Leeds, Leeds LS2 9JT, United Kingdom
[e] Formerly with the School of Engineering, University of Guelph, 50 Stone Road East, Guelph, ON N1G 2W1, Canada
[f] Rigolet Inuit Community Government, Rigolet, Labrador A0P 1P0, Canada

HIGHLIGHTS

- There were negative perceptions of the aesthetic quality and safety of tap water.
- High community adoption of a new Potable Water Dispensing Unit (PWDU) was reported.
- Gender and other demographic factors were associated with water consumption patterns.

GRAPHICAL ABSTRACT



ARTICLE INFO

Article history:
Received 5 July 2017
Received in revised form 16 October 2017
Accepted 24 October 2017
Available online xxxx

Editor: H.M. Solo-Gabriele

Keywords:
Indigenous
Nunatsiavut
Arctic
Drinking water
Perceptions
Consumption patterns

ABSTRACT

Concerns regarding the safety and aesthetic qualities of one's municipal drinking water supply are important factors influencing drinking water perceptions and consumption patterns (i.e. sources used and daily volume of consumption). In northern Canada, Inuit communities face challenges with drinking water quality, and many Inuit have reported concerns regarding the safety of their drinking water. The objectives of this research were to describe perceptions of municipal tap water, examine use of water sources and changes following the installation of a potable water dispensing unit (PWDU) in 2014, and identify factors associated with water consumption in the Inuit community of Rigolet. This study used data from three cross-sectional census surveys conducted between 2012 and 2014. Principal component analysis (PCA) was used to aggregate data from multiple variables related to perceptions of water, and logistic regressions were used to identify variables associated with water consumption patterns. Three quarters of residents reported using the PWDU after its installation, with concomitant declines reported in consumption of bottled, tap, and brook water. Negative perceptions of tap water were associated with lower odds of consuming tap water ($OR_{PCAcomponent1} = 0.73$, 95% CI 0.56–0.94; $OR_{PCAcomponent2} = 0.67$, 95% CI 0.49–0.93); women had higher odds of drinking purchased water compared to men (OR = 1.90, 95% CI 1.11–3.26). The median amount of water consumed per day was 1 L. Using brook water (OR = 2.60, 95% CI 1.22–5.56) and living in a household where no one had full-time employment (OR = 2.94, 95% CI 1.35–6.39)

* Corresponding author.
** Correspondence to: S.L. Harper, Department of Population Medicine, University of Guelph, 50 Stone Road East, Guelph, ON N1G 2W1, Canada.
E-mail addresses: carlee@uoguelph.ca (C.J. Wright), harpers@uoguelph.ca (S.L. Harper).
[1] Indigenous Health Adaptation to Climate Change Research Team: Lea Berrang-Ford, Cesar Carcamo, Alejandro Llanos, Shuaib Lwasa, Didacus Bambaiha Namanya, Guelph, Canada.

https://doi.org/10.1016/j.scitotenv.2017.10.255

were associated with consuming >2 L of water per day. Results of this study may inform drinking water interventions, risk assessments, and public health messaging in Rigolet and other Indigenous communities.

1. Introduction

Aesthetic characteristics play a major role in influencing perceptions of water quality (Abrahams et al., 2000; Doria, 2010; Doria et al., 2009), with taste often described as the most important factor impacting consumer perceptions (Abrahams et al., 2000; Doria, 2010). Additionally, perceived risk can deter users from particular water sources (Doria, 2010, 2006; Doria et al., 2009), and may be impacted by aesthetic qualities or attitudes toward chemicals or microbial contaminants in water (Doria, 2010). Boil water advisories, contamination events, or experiences of water-related illness can also negatively impact perceptions and consumption patterns (i.e., choices of drinking water sources and volume of water consumption) (Doria, 2010; Griffin et al., 1998). It is important that residents have access to a water supply that is trusted and positively regarded; unfavourable perceptions may lead individuals to drink alternative water sources or beverages (e.g. juice or soda), which may have negative financial and/or health implications (Dupont et al., 2010; Spence and Walters, 2012; World Health Organization, 2011).

Although literature describing perceptions and attitudes toward drinking water is well-established in urban populations (Doria, 2006; Doria et al., 2009; Jones et al., 2007a; Roche et al., 2012), a gap exists in literature relating to rural and remote locales, including northern Canada and Alaska. This knowledge deficit exists despite the unique and frequent water challenges that rural and remote populations often experience, when compared to urban centers in the same country (Bradford et al., 2016; Dunn et al., 2014; Hennessy and Bressler, 2016). For instance, smaller communities often do not have the financial resources or infrastructure to treat large quantities of drinking water with the advanced treatment methods found in urban regions (Kot et al., 2011). While these challenges have affected many remote communities in general across Canada, Indigenous communities are disproportionately impacted (Dunn et al., 2014; Patrick, 2011). Indeed, substandard, unreliable water services have contributed to issues with insufficient water quantity, water contamination, and frequent and/or long-standing boil water advisories in many Indigenous communities (Daley et al., 2014; Patrick, 2011). In Canada, a growing body of literature exists describing these persistent drinking water issues in First Nations communities (Basdeo and Bharadwaj, 2013; Dupont et al., 2010, 2014; Eggertson, 2006, 2008; Harden and Levalliant, 2008; Metcalfe et al., 2011); however, less is published regarding Inuit communities in northern Canada. Water-related issues in Inuit communities are often due to unique and challenging geography, climate, financial and human resources, and infrastructure (Marino et al., 2009; Medeiros et al., 2016). Collectively, these challenges have contributed to low consumer satisfaction of municipal water in many Inuit communities (Daley et al., 2015; Garner et al., 2010; Goldhar et al., 2013; Marino et al., 2009). For example, in the 2001 Aboriginal Peoples Survey, 100% of Inuit respondents from Rigolet reported that during certain times of the year, they believed their water was not safe (Statistics Canada, 2004). Water quality and quantity issues (Daley et al., 2014; Martin et al., 2007), lack of trust, and deep-rooted cultural values may encourage the consumption of non-municipal drinking water, such as untreated surface water from brooks or rivers (Goldhar et al., 2014).

In recent years, increased international attention and government funding for improving access to water and sanitation services has enabled some Arctic communities to begin addressing water-related challenges (Alaska Department of Health and Social Services and Alaska Native Tribal Health Consortium, 2015; Health Canada, 2016; United Nations, n.d.). Adequate funding that will support infrastructure and water-related research is crucial to achieving improved access to safe water in northern populations, particularly in-light of increasing stresses brought on by climate change and resource development (Ford, 2012; Instanes et al., 2016). In the past, various approaches have been taken to address water-related challenges. For example, in approximately one third of rural Alaskan villages, residents rely on centrally-located watering points, or "washeterias", due to lack of in-home water service for drinking or washing (Hennessy et al., 2008). Though well-intentioned, many factors can prevent the adoption of new or improved water systems, leading to residents choosing not to use new systems (Marino et al., 2009). Factors including local preferences for taste, integration of cultural values and Indigenous knowledge of water with water management, and sense of ownership over community water treatment systems often play integral roles in their adoption (Marino et al., 2009). Further research is still needed to understand why individuals prefer certain water sources. This is crucial for informing the development of appropriate municipal water systems and identifying potential barriers to their adoption.

Given the disproportionate water-related challenges in northern Canada, and the complex yet poorly understood factors that may impact water consumption patterns in Inuit communities, further work is needed to understand how to improve consumer satisfaction and trust in municipal water. While research exists assessing drinking water contamination in some Inuit communities (Martin et al., 2007; Wright et al., 2017), a gap exists in assessing how perceptions of safety and quality impact water consumption patterns. The goal of this research, therefore, was to characterize drinking water perceptions and consumption patterns in the Inuit community of Rigolet, Canada. The objectives were to: (1) describe perceptions of municipal tap water; (2) describe the use of drinking water sources and changes in water sources over time; (3) identify factors associated with consuming different water sources; and (4) examine residents' daily volume of water consumption. This study is intended to improve our understanding of specific factors that impact drinking water consumption patterns in order to inform sustainable drinking water interventions, water-related risk assessments, and effective public health messaging that considers the unique Indigenous context and history of water-related challenges in northern Canada.

2. Methods

2.1. Research location

First Nations, Métis, and Inuit are the three constitutionally recognized groups of Indigenous peoples in Canada, comprising 4.3% of the national population (Statistics Canada, 2015). Approximately three quarters of the almost 60,000 Inuit who live in Canada reside in Inuit Nunangat, a region which covers over one third of Canada's landmass (Inuit Tapiriit Kanatami, 2017). The four currently settled Land Claim Areas composing Inuit Nunangat include the Northern Labrador Inuit Land Claims Area (hereafter referred to as Nunatsiavut), Nunavik, Nunavut, and the Inuvialuit Settlement Region, although additional Inuit land claim negotiations are in progress (Fig. 1). Nunatsiavut, meaning "Our Beautiful Land" in Inuttitut, gained self-governance in 2005 (Nunatsiavut Government, 2016). The Nunatsiavut Land Claim Area is comprised of five coastal Inuit communities (from North to South): Nain, Hopedale, Postville, Makkovik, and Rigolet. These remote communities are not accessible by road, necessitating all travel by plane or boat or snowmobile in the winter. This study was conducted in