Drinking Water Quality in Canada: An Assessment of the Application of Guidelines and Standards

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Drinking water quality in Canada has been and continues to be a vital concern to the health of Canadians. Various reviews and assessments have addressed gaps in knowledge and governance of drinking water quality across Canada, and studies have shown that the drinking water management framework in Canada suffers from fragmentation and inefficiencies in several aspects. Drinking water quality is vital to the health of Canadians, and represents an important basic need. Inefficient management of our water resources, in addition to a lack of monitoring in water distribution, pose threats to Canadians' accessibility to secure and safe drinking water. Poor drinking water quality can cause serious immediate and long-term health threats, furthermore resulting in costly reactive measures to address waterborne outbreaks.

While each of the federal, provincial and territorial and municipal governments have made various initiatives to enhance the quality of Canada's drinking water, there is still a need for strong communication, consistency, and transparency among the legislatures, which is vital to a successful integrated management approach. The Guidelines for Canadian Drinking Water Quality[1] (CDWQG) illustrates the collaborative efforts of Health Canada and the Federal-Provincial-Territorial Committee on Drinking Water to set an international benchmark for Canada's drinking water quality. However, guidelines without application and rigorous enforcement fail to ensure the safety and quality of drinking water for its consumers in Canada.

The efficient use of a holistic framework for drinking water quality which encompasses the federal and provincial and territorial levels to the community municipality ensures not only that the proactive measure of oversight standards are being set, but also that in reality policies are being implemented in operation. Thus, this paper provides an analysis of the application of the Guidelines for Canadian Drinking Water Quality at the three levels of government: federal, provincial/territorial, and municipal, in order to assess the governance of drinking water quality in Canada, as well as the practicability of the guidelines by examining the implementation of proposed standards at each level of governance.

Literature Review

A systematic literature review was conducted for this study in order to assess the available body of literature pertaining to drinking water quality in Canada. The review focuses on publications from the last 20 years, and covers water-related journals, grey literature, and government publications

1 Federal – Provincial – Territorial – Committee on Drinking Water. Guidelines for Canadian Drinking Water Quality – Summary Table.

primarily from Canada. It also includes several assessments on an international scale in order to compare and contrast the effectiveness of Canada's drinking water management approach against other wealthy developed nations.

Recent reports from Boyd[2], the Sierra Legal Defence Fund[3], and the 2010 Ecojustice[4] drinking water assessment have set a benchmark for Canada's progress in comparison to the G8 and other wealthy developed nations internationally. While the Ecojustice Canadian water "report cards"[5] from 2001, 2006 and 2010 have illustrated some improvements to the governance of drinking water quality across the nation, overall, the report agrees with the 2006 commentary by Boyd: in that the current governance and monitoring of Canadian drinking water quality is still lacking and insufficient for ensuring access to safe drinking water in Canada. Overall, literature of international reviews on drinking water quality in wealthy developed nations suggests that Canada's management framework falls behind in comparison to other similar nations.

There are many key pieces that cover the Canadian approach to drinking water management; moreover, numerous sources provide detailed examinations of specific regions or provinces and territories of Canada in regards to drinking water resources. As well, other works focus primarily on the case studies of watershed and source water management. Several works have commented on proposed methods as well as existing approaches and have recommended models for efficient drinking water management. With reference to Canada, publications by Hrudey[6] have illustrated the inefficiencies of the lax and reactive approach by the Canadian government that ultimately slows research and development, and moreover, creates knowledge gaps and operational failures at the cost of the health of Canadians. In particular, Jalba et al. [7] stresses the importance of inter-agency communication and collaboration in order to create a robust and efficient management approach. Several key authors such as Boyd, Hrudey, and the Safe Drinking Water Foundation have argued strongly for the establishment of legally binding drinking water quality standards in Canada in order to ensure enforcement. This is one of the key debates in drinking water quality management in Canada, as there is a lack of enforceable standards at the national level.

There is also a thorough body of literature reviewing health-related issues regarding drinking water quality, particularly in Canada. Reports on waterborne diseases and outbreaks, such as the O'Connor report on Walkerton[8] and the Hrudey and Hrudey paper on both Walkerton and North Battleford[9] have detailed the serious health consequences to inefficiencies of drinking water quality monitoring. While microbiological pathogens are the main threats that cause disease outbreaks and acute health problems, a prolonged exposure to chemical and radiological contaminants also pose long-term health issues.[10] Reoccurring failures to implement existing governing structures, to ensure safe drinking water quality, have caused immediate and long-term illnesses which result in costly corrective measures. These publications highlight the serious consequences of failures to properly address and monitor drinking water quality risks and illustrate the importance of communication among legislation and stakeholders.

Several publications by Bakker, including Eau Canada,[11] document the fragmentation of governance in both source water and drinking water in Canada. Bakker highlights the lack of transparency and consistency in reporting across the nation[12]. Kathryn Furlong's[13] 2008 paper also provides a critical analysis of the struggle between federalism and subsidiarity in Canadian governance over drinking water quality, illustrating the benefits from both approaches, but overall suggesting that Canada would benefit from greater harmonization. Furlong argues that increased federal involvement can enhance equity and enforce the legislation of minimum requirements for source water upon which

2 D. Boyd, The water we drink: An international comparison of drinking water quality standards and guidelines, (Vancouver, BC: David Suzuki Foundation, 2006).

3 Sierra Legal Defence Fund (2006) Waterproof 2: Canada's Drinking Water Report Card. Prepared by Randy Christensen and Ben Parlin. Toronto: Sierra Legal Defence Fund, 2006.

4 ECOJUSTICE 2010 – DRINKING WATER 10 Y AFTER WALKERTON

5 Sierra Legal Defence Fund, Waterproof: Canada's Drinking Water Report Card, (Toronto: Sierra Legal Defence Fund, 2001).
Sierra Legal Defence Fund, Waterproof 2: Canada's Drinking Water Report Card, (Toronto: Sierra Legal Defence Fund, 2006).
Ecojustice, Seeking Water Justice: Strengthening Legal Protection For Canada's Drinking Water, (Toronto: Ecojustice, 2010).

6 S.E. Hrudey and E.J. Hrudey. Safe drinking water: Lessons from Recent Outbreaks in Affluent Nations. (London: IWA Publications, 2004).

7 Jalba D et al. Safe drinking water: Critical components of effective inter-agency relationships. Environment International 36 (2010).

8 D.R. O'Connor, Report of the Walkerton Inquiry (Toronto: The Walkerton Inquiry, 2002)

9 S.E. Hrudey and E.J. Hrudey. Walkerton and North Battleford – key lessons for public health professionals, Canadian Journal of Public Health, 93 (2002).

10 D. Boyd, The Water We Drink (2006)

11 Karen Bakker, Appendix A: A Survey of Water governance Legislation and Policies in the Provinces and Territories, (Vancouver: UBC Press, 2007).

12 Karen Bakker and Christina Cook. Water Governance in Canada: Innovation and Fragmentation. International Journal of Water Resources Development 27 (2011).

13 Kathryn Furlon get al., Harmonization versus subsidiarity in water governance: a review of water governance and legislation in the Canadian provinces and territories. Canadian Water Resources Journal 33 (2008) .

provincial and territorial variation can be built.[14] While there is strong debate from each side for both federalism and subsidiarity in governance, the literature generally suggests that Canada should implement enforceable federal standards for drinking water quality.

One of the more prominent ongoing concerns is the access and quality of drinking water resources on First Nations Reserves. While the scope of this paper will not address these concerns directly, as aboriginal communities fall under federal jurisdiction, literature on the topic has highlighted persistent deficiencies in the governance of drinking water quality in these communities. Despite these concerns, few improvements have occurred. This reflects the Canadian governments' ongoing inability to address vital drinking water quality concerns across the nation, and illustrates the importance of regular monitoring in order to ensure changes and improvements are made. The Walkerton Commission of Inquiry from 2002[15] gives a detailed review of issues with governance and regulation of drinking water quality on reserves, and both the 2006 and 2010 Ecojustice (formally the Sierra Legal Defence Fund) reports highlight that meeting the basic need of secure access to safe drinking water continues to be a pressing issue on First Nations Reserves. The lack of improvement to the quality and security of safe drinking water on reserves highlights poor governance by the federal government in their jurisdictions.

Assessments of Canada's overall drinking water approach also mirror the inefficiencies of addressing concerns in First Nations communities. Reviews of Canada's drinking water quality have been completed nationally in 2009 and 2010 by the Commissioner of the Environment and Sustainable Development.[16] Among other issues, the 2009 report has indicated that Canada suffers from out-dated guidelines due to the delay of reviewing health-related parameters. Although the 2010 audit commended Health Canada's recognition and response to the issues highlighted in the 2009 report, the Commissioner continued to urge respective governments and drinking water authorities to fulfill each of their roles and responsibilities in drinking water quality governance.

In summary, most publications that analyze drinking water quality governance across Canada echo Harrison's review of Canadian environmental policy[17], reflecting inefficiencies in a decentralized approach to environmental management. Ultimately, each level of government is hesitant to enforce, causing delays in research and innovation, and resulting in poor governance and regulation. Many key authors argue for greater federal involvement, and support the benefits of establishing nationally enforced drinking water quality standards. In response to this decentralized approach, Weibust[18] has offered an array of benefits in support of subsidiarity governance; despite this, the current Canadian framework for drinking water quality governance is not taking advantage of the strengths in scaling down governance responsibilities. Furthermore, the current approach towards drinking water quality in Canada is often constricted to managing water resources within political boundaries, which is inefficient, as the natural boundaries of water are rarely subject to such boundaries. Overall, key issues in the Canadian drinking water quality framework (as debated in the literature) reflect a resistance to implementation and enforcement at the higher levels of government, in addition to the lack of communication, consistency and transparency across the provincial and territorial jurisdictions, ultimately resulting in serious and costly health-related concerns for all Canadians.

Purpose of this Paper

This paper will examine if and how guidelines at the federal level are applied at the point of distribution, where drinking water is treated and supplied. This study looks at regulations in order to identify any gaps in the process of governance as it filters down to the municipal government. As the literature review illustrates, existing research pertaining to drinking water reflects broader reviews of top-down approaches to managing and governing drinking water in Canada. These generally encompass both the federal and the provincial and territorial governments, but do not assess the application and monitoring of drinking water governance and enforcement at the municipal governments across

14 Furlong, Katherine. Harmonization versus subsidiarity in water governance: a review of water governance and legislation of the Canadian provinces and territories. Canadian Water Resources Journal, 33(4), p. 315-333, 2008.

15 Walkerton Commission of Inquiry. First Nations (Chapter 15, Part 2), (Toronto: Publications Ontario, 2002).

16 Office of the Auditor General, Monitoring Water Resources, (Ottawa: Office of the Auditor General of Canada, 2010).
Office of the Auditor General. Chapter 1: Safety of Drinking Water, (Ottawa: Office of the Auditor General, 2009).

17 Kathryn Harrison, Passing the buck: Federalism and Canadian Environmental Policy, (Vancouver: UBC Press, 1997).

18 Inger Weibust, Green Leviathan: the Case for a Federal Role in Environmental Policy, (Burlington: Ashgate, 2009).

Canada. As the approach to drinking water quality governance is highly fragmented and inconsistent, a concurrent examination of the three levels of government and their governance of drinking water can shed vital light on understanding the practicability and application of drinking water quality guidelines and standards in Canada. This is crucial as greater consistency across the nation can enhance management harmonization, and cannot be done without a comparison of the actual application of national guidelines at the site of distribution – the municipalities – across Canada. Thus, this analysis can assess whether Canadians' drinking water truly meets our internationally benchmarked Guidelines, and ultimately evaluate the effectiveness of the Guidelines to protect the quality of drinking water and the health of Canadians.

In order to assess the drinking water quality at the site of distribution, monitoring and testing regulations will be compiled for a list of Canadian municipalities. The availability and accessibility of testing results will also be identified, in order to assess the transparency of monitoring practices. This analysis will identify any gaps in the methods of the application, monitoring and enforcement of guidelines and standards at the point of distribution. Finally, these gaps will be analyzed in order to address correlated implications to drinking water quality governance in Canada, and ultimately conclude by summarizing the findings to suggest how gaps in knowledge or inefficiencies in the application of guidelines and standards can affect Canadians. The findings can contribute heavily to connecting theory and practice in Canadian drinking water quality, and provide an assessment of the efficiencies of Guidelines in protecting the health of Canadians across Canada.

Methods of Analysis

In order to assess the governance and application of drinking water quality guidelines in Canada, this paper will identify regulations at federal and provincial/territorial levels, and examine if and how guidelines are observed at the point of distribution through a sample of Canadian municipalities. In order to assess governance and regulation of drinking water quality across the country, the largest population centre in each province or territory will be examined, in reference to the 2006 Census Canada[19] (2006 population sizes included in brackets):

The largest population centre in each province and territory:

Toronto, ON	(4,753,120), CMA
Montreal, QC	(3,316,615), CMA
Vancouver, BC	(1,953,252), CMA
Calgary, AB	(988,069), CMA
Winnipeg, MB	(694,668), CMA
Halifax, NS	(372, 858), CMA
Saskatoon, SK	(233,923), CMA
St. John's, NF	(181, 113), CMA
Moncton, NB	(126,424), CMA
Charlottetown, PEI	(58,625), CA
Whitehorse, YT	(22,898), CA
Yellowknife, NT	(18700), CA
Iqulait	(6,184), urban area UA

The effectiveness of drinking water governance will inevitably vary with the size of the municipality, as the size of a community can often affect its ability to fund and resource drinking water quality management tools. However, the effects of population size in relation to drinking water governance will not be discussed as it is not within the scope of this paper. The list of municipalities examined will provide a sample of large urban Canadian cities, in order to indicate any variance in drinking water quality governance at the municipalities in relation to the jurisdictions in which they are located.

For the comparative analysis this paper refers to the list of drinking water quality guidelines or standards compiled for each of the provinces and territories; it was completed in support of research currently being done by the Program of Water Governance at the University of British Columbia. At the municipalities, a similar list was collected by compiling drinking water quality standards and guidelines in reference to publications by the municipal health and/or environmental governments.

For the provinces and territories, the jurisdictional health department was consulted to obtain the regulations for drinking water quality governance. Each jurisdiction was contacted, in order to verify the existing regulations. Except Nunavut, all of the provinces and territories replied to confirm the current guidelines or standards in place. Provinces and territories had either published their own list

19 Population and Dwelling Counts, for Urban Areas, 2006 and 2001 Censuses, (Ottawa: Statistics Canada, 2008).

of parameters and guidelines, or simply referred to Health Canada's Guidelines. For the municipalities, the standards/guidelines were based on actual parameters for which drinking water was tested, and was based on drinking water quality reports issued and provided online by the city. Each municipality was individually contacted in order to ensure that the online reports were comprehensive, accurate, and up-to-date. Out of the thirteen municipalities contacted, all but Halifax, Charlottetown, and Iqaluit responded to confirm current guidelines and/or standards.

THE CANADIAN APPROACH TO DRINKING WATER QUALITY GOVERNANCE

An International Overview

The Canadian legislative structure for drinking water governance is characterized by vertical and horizontal fragmentation, in addition to an overall decentralized approach. The current model reflects inconsistent initiatives across the nation, as each of the provincial and territorial jurisdictions act as the main governments with legislative power to create legally binding standards for drinking water. This has resulted in an array of different guidelines and standards, each reflecting the result of a reactive "as-needed" basis for development[20].

In comparison to our international counterparts, Canada's decentralized approach has often been criticized as ineffective due to the federal government's lack of involvement[21]. Hrudey and Furlong in particular are advocates of a stronger federal presence, and lead the debate with examples such as the American and European Union's frameworks, as both demonstrate a strong centralized governing presence with legally binding and enforceable standards upon lower levels of government. While this is seen as an effective approach to drinking water quality management, Weibust presents a strong case for the decentralized approach; among many incentives, delegating legislative power to lower levels of government can encourage competition in research and development to create an overall "race to the top"[22] in environmental quality governance. Ultimately, the establishment of federal standards can ensure a minimal level of quality, upon which variation can be implemented to suit jurisdictional and local needs[23].

Australia's "Multi-Barrier Approach"[24] to drinking water governance is an example of where a federal government does not regulate legally binding standards, but instead produces drinking water quality guidelines. The Australian framework has received praise for its fairly effective and holistic approach in international assessments done by both Boyd and Ecojustice . While there are more prominent examples of effective centralized approaches to drinking water quality governance, Switzerland's highly integrated joint management at the canton level of government demonstrates a practical model of Weibust's decentralized framework. It is important to note that few of the G8 or developed nations have this decentralized approach. There is ongoing debate about the aptness of both approaches to drinking water quality governance, and it is evident that each can be successful with the application of an effective framework.

Overall, international assessments from Boyd[25] in 2006 and from Ecojustice in [26]2010 have agreed that Canadian guidelines for drinking water are less stringent than the US, EU, and Australia in comparison. Moreover, Canada's guidelines were also often below optimal recommendations from the World Health Organization in their Guidelines for Drinking-Water Quality[27]. Without drastic measures to improve the system for Canadian drinking water quality governance, our national benchmark will continue to trail behind standards of neighbouring developed countries.

Thus, why has Canada's drinking water quality fared poorer in comparison to our international counterparts? An in depth examination to the current Canadian framework for drinking water will reveal how our fragmented approach is inefficient for research and development of legislation, governance, and enforcement of drinking water quality in Canada.

20 Kathryn Harrison, Passing the buck: Federalism and Canadian Environmental Policy, (Vancouver: UBC Press, 1997).

21 Kathryn Harrison, Passing the buck: Federalism and Canadian Environmental Policy, (Vancouver: UBC Press, 1997).

22 Inger Weibust, Green Leviathan: the Case for a Federal Role in Environmental Policy, (Burlington: Ashgate, 2009).

23 Kathryn Harrison, Passing the buck: Federalism and Canadian Environmental Policy, (Vancouver: UBC Press, 1997).

24 S. Rizak et al., Drinking water quality management: a holistic approach, Water Science and Technology 47 (2003).

25 D. Boyd, The water we drink: An international comparison of drinking water quality standards and guidelines, (Vancouver, BC: David Suzuki Foundation, 2006).

26 Ecojustice, Seeking Water Justice: Strengthening Legal Protection For Canada's Drinking Water, (Toronto: Ecojustice, 2010).

27 Federal – Provincial – Territorial – Committee on Drinking Water. Guidelines for Canadian Drinking Water Quality – Summary Table, (Ottawa: Health Canada, 2010).

The Decentralized Approach to Drinking Water Quality in Canada

The decentralized approach to drinking water quality in Canada has not only been criticized by advocates of federalism as ineffective, but has also been argued to be inefficient as a decentralized approach to environmental governance[28]. Firstly, the overlap of jurisdictions and governing bodies pose challenges to drinking water quality. Nationally, the Federal-Provincial-Territorial committee on drinking water publishes the Canadian Drinking Water Quality Guidelines (CDWQG), which is not legally binding at the federal level. Thus, aside from areas that fall under federal jurisdictions[29], the provinces and territories are the main jurisdictions which have regulatory power over drinking water quality governance. Although the federal and provincial governments jointly create the CDWQG, it is left to the discretion of the provinces and territories to adopt these guidelines and/or make them legally enforceable. Harrison credits this decentralized approach to the reluctance of the federal government to be involved in governance and regulation[30]. Although the provincial and territorial governments are responsible for enforcing drinking water quality, it is often up to the municipal governments to monitor the drinking water quality at the site of water distribution. Thus, the current framework highlights a vertical fragmentation across the three layers of government, and reflects what Harrison terms a "top-down failure of responsibilities"[31]: each level of government fails to put their legislative power to use, resulting in a domino-effect of failures to fulfill roles and responsibilities. The federal government's hesitation to enact legally enforcing standards is followed by a reluctance to support and provide adequate financial, technical, and enforcement assistance, and this avoidance is mirrored by the provincial/territorial governments who further delegate enforcement responsibilities to the municipal governments that distribute drinking water.

A second problem lies in the nature of our water governance in Canada. Currently, there is a distinct separation between the protection and maintenance of source water and the management of drinking water, although the two are unmistakably interconnected. While source water protection is mainly considered an environmental concern and is managed primarily at the watershed by provincial and territorial jurisdictions, drinking water quality is a health concern, and regulation falls under the administration of municipalities that are responsible for distributing drinking water to urban centres. Drinking water, from its source to supply, illustrates a disconnect in governance. As suggested by Bakker[32], watersheds, which often do not align with political boundaries, cannot be efficiently managed without collaborative approaches by the provincial/territorial jurisdictions under which they fall. While source water is currently an environmental concern and drinking water quality a health concern, the two are closely interlinked regardless and require an integrated management framework. This will evidently require a change in our approach, in order to create governance that interconnects management of quantity and quality of water from its source to its distribution, while being reflective of its natural and not political boundaries.

Although the provincial and territorial governments are the main jurisdictions responsible for drinking water quality, these jurisdictions illustrate horizontal fragmentation in governance and monitoring of drinking water. Guidelines and standards for drinking water quality are inconsistent across Canada; some provinces have chosen to adopt the CDWQG and others haves created distinct guidelines or standards. Still others have unclear regulations for drinking water governance in their jurisdiction, as there is a tendency to simply refer back to the CDWQG, without concrete specification as to how much of the guidelines are adopted in the jurisdiction. Currently, only six of the thirteen provinces and territories (Alberta, Saskatchewan, Manitoba, Ontario, Quebec, and Nova Scotia) have adopted the CDWQG and made the guidelines legally-enforceable. Meanwhile, provinces that have adopted the CDWQG but have not made them enforceable (Newfoundland and Labrador, New Brunswick, Prince Edward Island, Yukon Territory and Northwest Territories) often do not specify if they have adopted all of the guidelines or a partial list. As the

28 Kathryn Harrison, Passing the buck: Federalism and Canadian Environmental Policy, (Vancouver: UBC Press, 1997).

29 Federal – Provincial – Territorial – Committee on Drinking Water. Guidance for Providing Safe Drinking Water in Areas in Federal Jurisdiction – Version I. Ottawa: Health Canada, 2005.

30 Kathryn Harrison, Passing the buck: Federalism and Canadian Environmental Policy, (Vancouver: UBC Press, 1997).

31 Kathryn Harrison, Passing the buck: Federalism and Canadian Environmental Policy, (Vancouver: UBC Press, 1997).

32 Karen Bakker, Good governance in restructuring water supply: A handbook, (Ottawa: Federation of Canadian municipalities and Toronto: Munk Centre for International Studies, 2002).

guidelines are not legally binding in these jurisdictions, the ambiguity in regulation has made it difficult to clarify if and what guidelines exist for drinking water quality. Evidently, despite the ability to regulate and enforce drinking water quality, the provinces and territories fail to fully utilize their legislative powers.

Similarly, the monitoring and reporting of drinking water quality is also differentiated across jurisdictions. This is highly problematic for all stakeholders involved, due to the inability to compare and contrast results from each of the jurisdictions, as strong communication can support improvements in policy and encourage a robust management approach across the nation. Thus, this fragmentation limits the ability to share information and knowledge across the provinces and territories, and the lack of knowledge lags the drive for research on drinking water quality in Canada. Furthermore, conflicting monitoring and reporting hinders the ability to assess risks to drinking water quality on a national level, and further delays research and development of drinking water frameworks on a national level. Few provinces publish comprehensive reports on the status of drinking water quality as a jurisdiction, often leaving the responsibility of testing and reporting to the municipal governments or treatment plants. The challenges associated with accessing drinking water quality information, in addition to the lack of transparency and consistency in the Canadian framework, hinders data collection and research for drinking water. An accessible and transparent knowledge database whether at one or both of the provincial and federal levels can increase research knowledge and also public awareness.

In jurisdictions where effective frameworks have been established, literature reviews have also highlighted that in many cases, there have been failures to efficiently implement adequate programs, in addition to a lack of expertise to govern properly[33]. As highlighted by Rizak et al.[34], Hrudey and Hrudey[35], and extensively in Justice O'Connor's Walkerton inquiry report, Canadian waterborne outbreaks have often been credited to ineffective oversight or lack of promptness to correct deficiencies. In the case of the 2000 Walkerton tragedy, contamination was already recognized in a 1978 hydrogeology report but the lack of continuous monitoring, in addition to the inefficiencies of oversight resulted in a lag in the boil-water advisory issuance, which followed ten days after the outbreak[36]. Hrudey argues that complacency and inactivity following the recognition of risks is often associated with inadequate training and provision of resources. This can be associated with the "top-down failure of responsibilities" that hinders each level of governments' ability to receive adequate funding and resources to ensure proper operation and training.

Ultimately, the current Canadian framework for drinking water illustrates a fragmented decentralized approach that is inefficient, resulting in threats to the health of Canadians. A disconnected approach to source water and distributed drinking water contradicts the natural characteristics of water, which should be managed holistically and irrespective of political confines or definitions based on function. The details of roles and responsibilities in governance and regulation are furthermore hindered by the inadequate use of existing legislative powers at each level of government; this forces heavy responsibilities on lower levels of government, which do not have sufficient funding and resources. Vertical and horizontal fragmentation also implicate the ability for existing jurisdictions to govern cohesively, as guidelines, standards, and practices are incompatible and difficult to access. Lack of data collection, as well as the inconsistencies across the nation, obscures the ability to assess drinking water quality nationally, implicating the ability to proactively identify health risks and hazards in drinking water. In conclusion, the host of inefficiencies illustrate a deficient framework for drinking water quality governance, monitoring, and regulation.

COMPARATIVE ANALYSIS

From Federal to Provincial

The provinces and territories remain the first level of government at which legislative powers may be used to make guidelines for drinking water quality legally enforceable. This delegating of governance to a sub-national government, as Weibust suggests, can encourage governments to tailor to local

33 S.E. Hrudey, Safe drinking water policy of Canada – Turning hindsight into foresight, (C.D. Howe Institute, 2011).

34 S. Rizak, Drinking water quality management: a holistic approach. Water Science and Technology 47 (2003).

35 S.E. Hrudey and E.J. Hrudey. Walkerton and North Battleford – key lessons for public health professionals. Canadian Journal of Public Health, 93 (2002).

36 S.E. Hrudey, Drinking-water risk management principles for a total quality management framework. Journal of Toxicology and Environmental Health 67 (2004).

needs while increasing competitive standards on a national scale. This is critical to managing water as a resource in Canada, as there is a high level of variation in climate and geography, resulting in differing watershed and ecosystem environments, as well as variations in consumer demands. By examining the guidelines and standards at the provincial/territorial governments in comparison to the Guidelines, a few observations can be made about the subsidiarity of legislative powers in our drinking water governance approach.

Table 3.1 illustrates the analysis of the application of the CDWQG in each of the provincial and territorial jurisdictions. The CDWQG published 77 maximum allowable concentrations (MAC's), which are health-related limits set for microbiological, chemical, and radiological parameters. Aesthetic Objectives (AO's) and Operational Guidance (OG's) recommendations were grouped together for a total of 18 limits, resulting in a grand total of 95 parameters in the Guidelines[37]. For the provinces in which the CDWQG have been implemented, the number of MAC's and AO/OG's adopted are specified by the province's drinking water quality authority and compared against the Guidelines in table 3.1.

Manitoba is the only province in which legally enforceable standards have been created separate to the CDWQG. In the jurisdictions where the Guidelines were adopted but not legally enforceable, the amount of MAC and AO/OG parameters were based on the details listed in reference to the drinking water governance authority of each jurisdiction. Newfoundland, Yukon and Northwest Territories are calculated based on full adoption of the CDWQG, as they do not have a specified list of adopted parameters. Finally, Nunavut Territory's data is omitted as it falls under federal jurisdiction, and will not be compared in the provincial/territorial analysis.

Only six provinces have currently created legally binding standards for drinking water quality (Alberta, Saskatchewan, Manitoba, Ontario, Quebec, and Nova Scotia). Of these six jurisdictions, only four provinces—Alberta, Manitoba, Ontario, and Nova Scotia – have adopted or created enforceable limits for more than 86% of the original 95 health and aesthetic recommendations listed in the Guide-

37 Federal – Provincial – Territorial – Committee on Drinking Water. Guidelines for Canadian Drinking Water Quality – Summary Table, (Ottawa: Health Canada, 2010).

Table 3.1 Application of the CDWQG: Provinces and Territories

		# of parameters at province	% uptake from federal to provincial	Adopted CDWQG?	Legally Enforceable?
Fed	MAC's	77			
	AO/OG	18			
	total	**95**			
BC	MAC	79	100.0	N	N
	AO/OG	16	88.9		
	total	**95**	100.0		
AB	MAC	70	90.9	Y	Y
	AO/OG	12	66.7		
	total	**82**	86.3		
SK	MAC	42	54.5	Y	Y
	AO/OG	18	100.0		
	total	**60**	63.2		
MB	MAC	80	100.0	N	Y
	AO/OG	18	100.0		
	total	**98**	100.0		
ON	MAC	86	100.0	Y	Y
	AO/OG	19	100.0		
	total	**105**	100.0		
QC	MAC	73	94.8	Y	Y
	AO/OG	1	5.6		
	total	**74**	77.9		
NF	MAC	72	100.0	Y	N
	AO/OG	18	100.0		
	total	**90**	100.0		
NB	MAC	27	35.1	Y	N
	AO/OG	9	50.0		
	total	**36**	37.9		
NS	MAC	70	97.2	Y	Y
	AO/OG	16	88.9		
	total	**86**	95.6		
PE	MAC	8	10.4	Y	N
	AO/OG	11	61.1		
	total	**19**	20.0		
YT	MAC	77	100.0	Y	N
	AO/OG	18	100.0		
	total	**95**	100.0		
NT	MAC	77	100.0	Y	N
	AO/OG	18	100.0		
	total	**95**	100.0		
NU	MAC			n/a	n/a
	AO/OG				
	total				

lines. The other two provinces, Saskatchewan and Quebec, currently have 63.2% and 77.9% of the original list of parameters. Although they have fewer parameters, overall they illustrate a fair amount of uptake from the original federal recommendations. However, of the remaining jurisdictions (British Columbia, Newfoundland and Labrador, New Brunswick, Yukon Territory, Northwest Territories), only British Columbia has a detailed list of parameters and limits that meet the qualifications of the CDWQ. The other five provinces and territories that do not have enforceable standards either adopt less than 40% of the original Health Canada list, or do not clarify to what extent they have adopted the CDWQ.

Based on the current guidelines and standards at the provincial and territorial jurisdiction, it is evident that there is a wide range of quality regulations. However, it is still observed that there is greater stringency for drinking water quality in provinces where there are legally binding standards in comparison to jurisdictions without enforceable standards. Excluding Newfoundland, Yukon Territory and Nunavut, which simply referred to the Canadian Guidelines for Drinking Water Quality with regards to their jurisdictional governance details, it is evident that in provinces where legally binding standards were not issued, less than half of the Guidelines were adopted. In New Brunswick and Prince Edward Island, where the CDWQG is adopted but not enforced, the list of parameters available to the public is less than half of Health Canada's recommendations. With the exception of British Columbia, the jurisdictions and their established guidelines and standards illustrate that higher drinking water quality standards are correlated with the enforceable and legally binding regulations.

These findings are significant as they illustrate that there is a lack of consistency in governance, as well as a lack of policy created at levels of governments where legislative power to create these policies are held. Despite the ability to create detailed guidelines and/or standards, not all of the provinces/territories have fulfilled this responsibility, despite the importance of safe and secure drinking water quality in Canada. Hence, while a subsidiarity approach may encourage more tailored governance to suit local needs, it is hindered by the provincial/territorial government's hesitation to put their legislative powers into effect.

Despite varying levels of uptake from federal to provincial governance, there is an overall trend for fewer guidelines and standards as policy moves from federal to provincial/territorial governments. These results are particularly disheartening given that the Guidelines are already deemed less stringent than other wealthy developed nations. Increased laxation in drinking water policy as it moves through the levels of government, further reduces the quality and control of this governance and increases the risk of threats to the health of Canadians. This is even more distressing in jurisdictions where little clarification is given as to what guidelines or standards are adopted other than a reference link to the CDWQG. Ultimately, effective regulation cannot be enforced without clear and concrete establishment of guidelines and standards, regardless of whether they are legally binding.

Municipalities: Application of Guidelines at the Point of Distribution

Municipalities represent the juxtaposition between policy and operational application. An assessment of the testing parameters at each of the most populated urban municipalities, in each jurisdiction, will provide a sample review of a concrete implementation of the CDWQG.

Table 3.2 reflects the adoption of the Guidelines at each of the municipalities, listed by province or territory. Percentages are given for both adoptions of guidelines from the federal to municipal ratios, as well as the provincial/territorial to municipal level. All of the data is based on drinking water quality reports published by the cities, with the exception of Halifax and Charlottetown, as they were not able to provide reports upon contact with local authorities. Both cities publish annual water reports for consumers, but do not release comprehensive drinking water quality reports to the public. The amount of MAC and AO/OG parameters is based on the number of actual parameters tested for at each of the drinking water distribution sites within the municipalities. Again, Nunavut Territory's information was not included as it is considered a federal jurisdiction.

Five of the municipalities (Calgary, Saskatoon, Toronto, Quebec City, and Halifax) illustrate an uptake of more than 80% of their jurisdictions' list of guidelines/parameters. These are also the only cities in which the jurisdictions have adopted the

Table 3.2 Application of the CDWQG: Municipalities

Federal	MAC's	77				
	AO/OG	18				
	total	95				
		# of Parameters at municipal	% Uptake from provincial to municipal	% Uptake from federal to municipal	Adopted CDWG?	Legally enforceable at provincial level?
BC	MAC	20	25.3	26.0	N	N
Vancouver	AO/OG	11	68.8	61.1		
	total	31	32.6	32.6		
AB	MAC	68	97.1	88.3	Y	Y
Calgary	AO/OG	18	100.0	100.0		
	total	86	100.0	90.5		
SK	MAC	47	100.0	61.0	Y	Y
Saskatoon	AO/OG	14	77.8	77.8		
	total	61	100.0	64.2		
MB	MAC	41	54.7	53.2	N	Y
Winnipeg	AO/OG	13	72.2	72.2		
	total	55	58.1	56.8		
ON	MAC	84	100.0	100.0	Y	Y
Toronto	AO/OG	13	68.4	72.2		
	total	97	97.0	100.0		
QC	MAC	60	87.0	77.9	Y	Y
Quebec City	AO/OG	11	100.0	61.1		
	total	71	100.0	74.7		
NF	MAC	16	22.2	20.8	Y	N
St. John's	AO/OG	10	55.6	55.6		
	total	26	28.9	27.4		
NB	MAC	17	63.0	20.8	Y	N
Moncton	AO/OG	9	100.0	55.6		
	total	26	72.2	27.4		
NS	MAC	56.0	80.0	72.7	Y	Y
Halifax	AO/OG	14.0	87.5	77.8		
	total	70.0	81.4	73.7		
PE	MAC	n/a	n/a	n/a	Y	N
Charlottetown	AO/OG	n/a	n/a	n/a		
	total	n/a	n/a	n/a		
YT	MAC	12	16.7	15.6	Y	N
Whitehorse	AO/OG	14	77.8	77.8		
	total	26	28.9	27.4		
NT	MAC	16	22.2	20.8	Y	N
Yellowknife	AO/OG	11	61.1	61.1		
	total	27	30.0	28.4		
NU	MAC				n/a	n/a
Iqaluit	AO/OG					
	total					

CDWQ and made them legally enforceable standards. In Winnipeg, where the CDWQ was not adopted but standards were enforced by the provincial government, the municipality uptake of the guidelines was close to half from the provincial as well as from the federal government.

Contrarily, for the cities without enforceable jurisdictional standards, monitoring requirements for drinking water quality reflect less than 35% uptake of the Guidelines' parameters. Again, in jurisdictions with enforceable standards, increased amount of testing parameters are seen at the municipalities. These six municipalities also illustrate decreased stringency as governance moves from provincial/territorial jurisdictions to municipal governments.

In general, the majority of municipalities (except Calgary, Saskatoon, and Quebec City) illustrate the trend of having fewer guidelines and/or standards as governance moves from provincial/territorial to municipal governments. This again illustrates that the governance of water quality tends to relax as it moves down in the levels of government.

Vancouver and British Columbia present a distinct case. Here, the provincial jurisdiction had more than Health Canada's list of parameters; however, the municipality testing parameters were composed of only a third of the Guidelines. This provides a strong example of the difference in operational results based on whether standards are legally enforceable. As illustrated in table 3.1, Ontario, Manitoba, and British Columbia had 100% of the original 95 parameters detailed in the Guidelines. However, as legislature devolves to the municipal level, only the five cities that adopted the CDWQ and made them legally binding standards (Calgary, Saskatoon, Toronto, Quebec City, and Halifax) demonstrated more rigorous testing practices at the site of distribution. In Vancouver, where standards are not enforceable by the province, less than a third of Health Canada's health objectives (MACs) were tested for in the distribution of drinking water.

Accessibility and Transparency

Access to information is a persistent concern for research and analysis of water quality in Canada. Whereas regulations and guidelines often exist, public accessibility of this information has often been obscure and difficult to locate[38]. While many of the provinces have established and published guidelines and standards for public viewing on the internet, retrieval of this information is complicated and often shrouded behind layers of unorganized presentation. Online drinking water reports are often not comprehensive, although this is only revealed upon contact with the local drinking water and/or health authorities. Reports issued for general consumers may also differ from reports issued for water quality and/or government officials. Moreover, each jurisdiction has a distinct method of data collection and a distinct reporting format. Different jurisdictions have different delegations for the testing, collecting, and publishing of drinking water quality data, and few jurisdictions detail the roles and responsibilities of this process, making it difficult for consumers to know where to find information or whom to contact for further inquiry. In summary, access to jurisdictional drinking water quality regulation information is difficult, moreover challenging for forming a collective interpretation as a nation.

For the municipalities, testing and monitoring results are similarly difficult to access. All of the municipalities (excluding Nunavut, which falls under federal jurisdiction) publish regular drinking water quality reports, with the exception of St. John's and Whitehorse, which present raw data tables for drinking water quality monitoring. However, in Calgary, Whitehorse, Saskatoon, and Halifax, drinking water quality reports for consumers merely summarized the results from key parameters; and detailed monitoring reports were only available upon request for the local drinking water quality authority. In all of the municipalities, clarification was required in order to confirm whether consumer reports reflected comprehensive or summarized results. This can be misleading for consumers as non-officials may not be aware that reports contain differing amounts of details depending on the type of request.

Difficulty in accessing drinking water quality information presents various implications. Firstly, complicated access to drinking water quality indicates little transparency in drinking water quality frameworks. Increased transparency is vital to public accountability of public water systems, in addition to enhanced consumer awareness. Secondly, inconsistent data collection and presentation impli-

38 Karen Bakker and C. Cook, Water Governance in Canada: Innovation and Fragmentation, International Journal of Water Resources Development 27 (2011).

cates the ability to assess drinking water quality across jurisdictions. This can be highly problematic for watersheds in which jurisdictions overlap, as information presented can be incompatible or inconsistent. Regular and reliable reporting on a national scale is a vital component in assessing current risks and threats to our drinking water quality, and insufficient or undependable data creates knowledge gaps about Canada's national watershed, ultimately hindering the ability to take proactive measures in our approach to addressing health-related concerns in our drinking water quality.

Analysis of the Results

The comparative analysis across the three levels of government has revealed several patterns in the movement of drinking water quality regulations, and has demonstrated the degree to which federal policy is implemented at site of distribution. Firstly, it is evident that there is a general trend across the nation for decreased stringency in the governance of drinking water quality as governance moves down the levels of government. This encourages the support for greater quality guidelines and standards at the federal level, as the pattern illustrates that the resulting quality of drinking water to reach consumers will likely have quality standards that are more relaxed than detailed in policies at the federal level.

Secondly, the analysis of the results illustrates a need for legally binding standards at the provincial/territorial level. Evidently, in jurisdictions where standards are enforced, the municipalities generally have more parameters and thus are testing more for drinking water quality at the site of distribution. Vancouver and British Columbia, is a crucial example of where the detail in governance policy at both federal and provincial levels do not directly result in implementation during operation. This is important as policies are only effective if implemented, and in this case, failures in governance can lead to serious health consequences for the majority of Canadians.

This current analysis assesses efficient drinking water quality governance at these thirteen municipalities, which represent nearly 40% of Canada's 2006 population[39]. This overview of the use of the Guidelines at the municipal level illustrates the wide variance in adoption and testing of Health Canada's recommended parameters. This encourages the establishment of legally binding standards, as the patterns illustrate greater compliance in testing and monitoring practices where enforceable standards exist.

While these results exemplify drinking water quality testing and monitoring parameters for only one urban municipality in each province, it is important to note that urban cities also represent operational application at locations where resources and funding are most available and accessible. Therefore, this overview of the largest municipalities by jurisdiction only, illustrates an arguable maximum competency of a municipal government to address drinking water quality governance, and therefore does not reflect other issues in funding and infrastructure that may be pertinent in smaller cities.

CONCLUSIONS AND RECOMMENDATIONS

Detailed and stringent parameters in combination with effective monitoring practices contribute to safe drinking water for Canadians. The adoption of guidelines for the testing and monitoring of drinking water quality at the municipal level illustrate the degree of implementation of the Guidelines.

While the current framework for drinking water quality can be effective by using subsidiarity governance to tailor to local needs at each jurisdiction, it is evident that our framework does not take advantage of this decentralized approach. While legally binding regulations in the jurisdictions do not guarantee enhanced drinking water quality within them, the analysis illustrates that they can encourage more stringent monitoring practices and regulations. This can ultimately lead to greater awareness about relevant drinking water quality risks and threats, fuelling research and development initiatives. The effective and consistent reporting of drinking water quality also enhances knowledge and awareness of Canada's overall water quality. This creates a knowledgeable foundation to steer research and development and drive enhancements in monitoring against drinking water risks and hazards.

In summary of the analyses, the results of this paper align with a majority of the published literature on the insufficiencies of the current Canadian approach to drinking water quality. Several key conclusions are emphasized as a result of this analysis.

The assessment of the application of the Guide-

39 Refer to 2006 Census Canada population statistics, http://www12.statcan.ca/english/census06/data/popdwell/Table.cfm?T=101

lines has revealed that the actual implementation of the drinking water quality recommendations made by Health Canada in collaboration with the Federal-Provincial-Territorial-Committee on Drinking Water are hindered largely by failures in the current decentralized approach. In Harrison's identification of the "top-down failure in responsibilities,"[40] municipalities are forced to bear the primary stress in the practical and operational aspects of monitoring drinking water quality, while the provincial/territorial and federal governments remain chiefly policy components to governance. This is highly problematic as many municipal governments neither receive nor possess sufficient funding and resources for the successful regulation of drinking water quality, especially in areas where communities are smaller[41]. Although the provinces and territories have the ability to impose enforceable standards for drinking water quality, it is evident that some jurisdictions have yet to exercise this legislative power. For the provinces and territories that have not taken this initiative, the results correspond with municipalities that suffer from weak drinking water quality monitoring and testing. At the same time, provinces that have enforced legally binding standards have exemplified greater testing requirements in their municipalities. In reference to knowledge gaps and fragmentation in the Canadian approach to drinking water quality governance, the analysis has reiterated the incapability of the decentralized approach. Monitoring and testing results are inconsistent, incompatible, and unreliable among the urban centres examined in this paper.

While the provincial and territorial jurisdictions illustrate a wide range in the degree of uptake from Health Canada's recommended Guidelines, the most important factor lies in the extent of the application of standards at the distribution sites, as this determines the actual quality of drinking water for consumption. The analysis finds that despite the level of uptake at the provincial and territorial jurisdictions, the ultimate drinking water quality ensured by testing at the municipal site of distribution is greater where the municipality falls under a jurisdiction with legally- enforceable standards. Based on these results, the paper concludes that provincial and territorial enforcement of standards is vital for ensuring safe drinking water quality at the site of distribution.

Several recommendations are encouraged in response to the analysis of the application of the standards and guidelines for drinking water quality governance. Each jurisdiction needs to have a clearly defined set of standards that are legally-enforceable, in addition to the publication of a comprehensive list of testing parameters for municipalities within each jurisdiction. As shown, this can assist in facilitating great testing requirements at the site of distribution, thereby increasing the actual quality of drinking water for consumption. Furthermore, each province and territory also needs to have a regulated practice of reporting of drinking water quality testing and compliance, as the current practices are difficult to access and not transparent. Lastly, greater stringency for drinking water quality is encouraged at the federal level, as it is evident from the analysis that the detail in guidelines and standards are decreased as governance moves from upper to lower levels of government. A greater amount of parameters at the federal level can proactively buffer against this effect, and will help Canada strive towards a higher benchmark for drinking water quality on an international scale.

In summary, this assessment concludes that the current Guidelines to Canadian Drinking Water Quality serves as a competent guide to drinking water quality governance in Canada; however, its practicability suffers from the lack of operational application. This can be largely credited to the decentralized and fragmented governance across the jurisdictions, in addition to the reluctance in exercising legislative powers held by the provincial/territorial governments. In the analysis, the results illustrate that lax regulations through the lack of standards often correlates with minimal testing and monitoring of drinking water quality at the site of distribution. Fragmentation across the jurisdictions also results in unreliable and inconsistent monitoring and reporting, hindering research and implicating the ability to effectively identify risks and threats to drinking water quality. This overall assessment reveals a pattern that is consistent with the current drinking water governance approach; the Guidelines represent legislative potential that could be used to efficiently enhance drinking water quality, but at present it is primarily limited to policy as it suffers in practical implementation. In order to address these concerns, the provincial and territorial jurisdictions are encouraged to ful-

40 Kathryn Harrison, Passing the buck: Federalism and Canadian Environmental Policy, (Vancouver: UBC Press, 1997).

41 Karen Bakker, Eau Canada (Vancouver: UBC Press, 2007).

fill their legislative capabilities and enforcement roles, by creating legally binding standards for drinking water quality. Meanwhile, there is also a need to ensure greater consistency in compliance and reporting across the nation, in order to address knowledge gaps and encourage a more comprehensive and integrated drinking water quality management framework.

Ultimately, the provincial/territorial jurisdictions need to fulfill their responsibilities in implementing legally binding standards for drinking water quality, in order to facilitate greater implementation of the Guidelines at the site of distribution. Canadian drinking water quality policies from upper-level governments are only practical if applied at the municipal site of distribution, where they ensure the highest quality of drinking water for consumers and thereby protect the health of Canadians.

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