

A review on oral health care in four different health care systems

Mario Brondani (✉ brondani@dentistry.ubc.ca)

University of British Columbia <https://orcid.org/0000-0003-2437-4552>

Kavita Mathu-Muju

University of British Columbia

Pia Skott

Karolinska Institutet

Gunilla Sandborgh-Englund

Karolinska Institutet

Fernando N Hugo

Universidade Federal do Rio Grande do Sul Instituto de Ciencias Basicas da Saude

Thiago Ardenghi

Universidade Federal de Santa Maria

Moira Smith

University of Otago

W Murray Thomson

University of Otago

Research article

Keywords: Universal oral health care, oral health outcomes, oral health disparities, critical literature review

Posted Date: February 26th, 2020

DOI: <https://doi.org/10.21203/rs.2.16316/v2>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Background : A universal approach to oral health is said to improve oral health outcomes, but research has shown mixed results. This study aimed at critically reviewing the literature available on the oral health care systems of four countries in terms of structure, scope, and delivery, along with their impact on oral health outcomes.

Methods : A comparative literature review of the oral health care systems in Brazil, New Zealand, Canada, and Sweden was performed between August 2017 and January 2018 using PubMed/MEDLINE and the key words ‘universal’ OR ‘publicly funded’ AND ‘dental OR oral’ AND ‘care OR access’ AND ‘outcome’. This is a critical essay based on evidence available in the literature that was enriched by accounts from 12 key informants from these four countries.

Results : All four countries provide some form of universal health care, but the administration, funding, and delivery of oral health care varied. Approximately 6% of oral health care expenditure in Canada is publicly funded. Brazil provides full publicly-funded oral health care at the point of use via salaried dental professionals, while Sweden offers a high-cost protection plan favouring those with greater needs, and New Zealand delivers publicly-funded oral health care to children up to their eighteenth birthday. With service utilization varying, 61% percent of Canadian children, 67% of Swedish children, 50% of Brazilian children, and 45% of New Zealand children are caries-free at age 12, while 6.4%, 0.8%, 6.5%, and 9.6% of adults between the ages of 20 and 79 years are edentulous, respectively.

Conclusions : All countries have some form of publicly-funded oral health care, but vary in the way that the services are delivered, from salary-based providers to private-practice models. Service utilization and oral health outcomes differ in each country.

Background

Oral health has a significant impact on overall health and quality of life, and yet it remains neglected and overlooked in most health care systems (1). Social disparities in access to oral health services are found almost everywhere, but they are more prominent in countries where oral health care is administered, funded, and delivered predominantly through the private sector (2, 3). In turn, those bearing the greatest burden of dental disease tend to be members of socially and economically deprived segments of the population that are least likely to be able to afford oral health care (4).

Arguably, a publicly funded or “universal” approach to oral health would eliminate or reduce the impact of affordability as a barrier; it is also believed to improve oral health outcomes and lessen inequities (5). This manuscript employs the term universal oral health care to refer to the type of care that is universally-funded by the federal government or a central agency (either by tax payers or by subsidized care provided by an “insurer”) and is available to all people regardless of their ability to pay. However, research on the impact of universally-funded oral health care on access to treatment and on outcomes remains sparse and with mixed results (6,7).

Given that publicly-funded or universal oral health care likely exists within an equally publicly-funded or universal health care system, a comparative review amongst Canada, New Zealand, Brazil, and Sweden is presented and discussed in terms of their oral health care systems' structure, scope, and service delivery, as well as their impact on the oral health of their populations. These four countries were selected because they all offer some sort of universal or a financially subsidized health care system to offset the cost of some, or all, health care needs of their respective populations; they are geographically placed in different areas of the globe (e.g., two are in the Northern and two are in the Southern hemispheres; two are located in the Americas while one is in Europe and the other is in Australasia) and they offer four different ways to fund and deliver oral health care. This study recognises the similarities and differences between the countries studied, while acknowledging the influence of an array of factors upon care utilization, including age, gender, educational level, geographic location and acceptability of the services, and perceived need for and benefit from care, that were not included in this current manuscript. As a critical essay, this study aimed to explore the available literature and to discuss extent to which four different oral health care systems impact three selected oral health outcomes, including service utilization (i.e., visiting a dentist in the previous 12 months), dental caries experience via Decayed-Missing-Filled-Teeth (DMFT) in 12-year-olds, and edentulism (i.e., being toothless) in adults between the ages of 20 and 79.

Methods

A comparative literature review and conversations with 12 key informants from four national oral health care systems was performed:

- 1) The Brazilian Unified Health System;
- 2) The New Zealand Dental Care System;
- 3) The Swedish Dental Care Benefits Scheme;
- 4) The Canadian Public Health Care System.

This study employed a brief structured search on PubMed/Medline using the key words 'universal' OR 'publicly funded' AND 'dental OR oral' AND 'care OR access' AND 'outcome' (limited to Brazil, Canada, New Zealand, and Sweden) between August 2017 and January 2018. These keywords were used to acquire the relevant literature on oral health care delivery systems that were universal and to explore the impact of such systems on oral health outcomes. In particular, inclusion criteria aimed at identifying any publication (peer reviewed manuscripts, conference procedures, reports, and reviews) pertaining to those four countries that contained the selected key words, e.g. publications that dealt with the chosen oral health outcomes in light of their respective oral health care systems. No limits on the year of publication were imposed in order to retrieve historical information pertaining to the establishment of the health and oral care system in those respective countries.

The search was supplemented by specific yet informal requests from key informants in each country. The twelve purposefully selected key informants were academics (n=3), administrators/managers of oral health care programs (n=3), and oral health care professionals (n=6) identified as those with first-hand experience about their respective health care systems and could offer a unique take on the following question: "*what would be a positive and a negative aspect of your oral health care delivery system?*" This question aimed at revealing more information and details about the respective systems beyond the published literature, providing an insider view. Given the nature of this question, it may have introduced personal biases rather than verifiable accounts although the informants were asked to give their ideas on a positive and a negative aspect or quality of the systems they were working with. This study did not entail a qualitative inquiry that would require a theoretical framework, an interview guide, a sampling strategy, and discussion around saturation and generalizability of the findings, for example. And unlike a qualitative inquiry, answers to the above question were not analyzed thematically for their content; rather they were used to illustrate the experiences of those working within the four different oral health care systems. Hence, the answers to the above question were by no means exhaustive or generalizable. The purposefully selected key informants were approached by the first author (MB) between September 2016 and August 2017[1] and were asked to also identify any supporting grey literature that would not likely surface during our literature search. Such interaction with the first author occurred informally via face-to-face and electronic communication, were written notes were kept and no audio recording was utilized. When applicable, quotes from these interactions were used to support or refute our line of reasoning when discussing the literature findings; these quotes are summarised in table 2.

[1] The first author (MAB) was on a 1-year sabbatical from September 1, 2016 to August 31, 2017 during which he visited various Faculties of Dentistry in Brazil, New Zealand, and Sweden.

Results

The search strategy described above yielded 882 documents after 36 duplicates were excluded. The first author (MB), limited these 882 documents to journal articles, commentaries, reviews, and systematic reviews as indexed at the search engines used and eliminated 156 publications at the title level that were about animal studies and 29 that were in languages other than English, Portuguese, Italian, Spanish, and Swedish (which the authors could understand). The remaining 697 abstracts were gathered and read by two co-authors (MB ad KMM) who further eliminated 245 abstracts without a full text – for a subtotal of 451 full-text publications; these two authors are mid-career researchers with a vast number of published critical reviews and with expertise in the area of access to care and the social determinants of oral health. These two authors read separately the entirety of these 451 documents and met to discuss which publications to exclude. Collectively, they eliminated publications describing health care for systemic diseases only (n=261), discussing medications with oral side effects and not the care system in itself (n=38), presenting laboratory and clinical studies in dentistry only (n=67), conversing about infection and vaccination only (n=16), and genetic and unrelated studies (n=11), which resulted in 68 publications. The

grey literature suggested by the key informants yielded 11 additional publications – for a final total of 79 documents (Figure 1). As some of these 79 documents contained similar information, we tried to avoid reiteration of unnecessary data by using 38 of these manuscripts, reports, theses, and book chapters in support of the findings advanced by our study, ahead. A full list of the 79 publications is available from the corresponding author upon request. The literature review enabled us to offer a critical discussion on various health care systems and their impact on selected oral health outcomes. Although comprehensive, the literature review was not meant to be exhaustive nor systematic, and no quality assessment of the 79 publications was performed; publication bias likely occurred and was one of the limitations of this study.

(insert here) Figure 1 – Searching strategy for the 79 selected publications

The answers gathered from 12 key informants were summarised in point form in Table 2, while some of the full quotations are presented in the discussion–when needed to support the claims made. As they were prompted to reflect on at least one positive and one negative point pertaining to their respective oral health care systems, the answers were evened out; we eliminated repetitive points mentioned by different individuals. Although anonymity was guarantee for their participation, some information is provided in terms of area of work (e.g., academia, private practise, etc.), age, and the number of years working in that capacity.

(insert here) Table 2 – Summary points from the key informants' interviews

In order to discuss the impact of the four health care systems on oral health outcomes (e.g., service utilization, dental caries experience, and edentulism), a summary of the findings pertaining to the scope and structure of the four health care systems, to the way oral health care is delivered, and to the available oral health work force is presented ahead.

Health care systems: scope and structure

All four countries offer some form of universally-funded health care to their citizens, with Brazil, Canada, New Zealand, and Sweden spending 8.3%, 10.4%, 11.0%, and 11.9% of their Gross Domestic Product (GDP) on health care, respectively (8) (Table 1).

Canada: Publicly-funded health care is financed with general revenue raised through federal, provincial, and territorial taxation. The provinces and territories administer and deliver most of Canada's health care services under a private model within the Canada Health Act, without direct charges to the patient. All health care services must adhere to the five principles of the Canada Health Act: 1) publicly administered; 2) comprehensive in financial coverage of care; 3) universally available to all Canadians; 4) portable across provinces; 5) and accessible (i.e., without user fees) (9).

Brazil: The Unified Health System ("Sistema Único de Saúde" – SUS) oversees the payment and delivery of health services publicly provided at federal, state, and municipal levels with complementary participation of the private sector; this public-private mix led to less than half of health spending actually being funded by public sources alone (8,10,11). The SUS works under the three basic principles of

universality, equity, and comprehensiveness informed by decentralization, regionalization, and social control (11).

New Zealand: The public health care system is government funded; it is a complex net of various agencies at different levels and includes the Ministry of Health, the Pharmaceutical Management Agency, and the Health Quality and Safety Commission. Although there are no deductibles, co-payments are required for general medical practitioner's services. New Zealanders residing in low-income areas have their annual per-patient capitation paid for medical care and, in return, patient co-payments are capped (12).

Sweden: All three levels of Swedish government – national, regional, and local – are involved in the health care system. Much like Canada and Brazil, there are no direct charges to the patient for treatment. The principles of health care in Sweden mandate the system to offer equal entitlement to dignity and the same rights regardless of individual status in the community, to give priority to those in greatest need of care, and to be cost effective in all its levels (13).

(insert here) **Table 1 – Population size, gross domestic product and per capita income, GINI index, health and oral health expenditure, number of dental schools, dental workforce, and oral health outcomes in Brazil, Canada, New Zealand, and Sweden**

Oral health care delivery

Public funding and delivery of oral health care exists to varying degrees in all four countries. In Canada, the provision of these services has been excluded from the Canada Health Act, with the exception of the federal government's responsibility to provide oral health care to Indigenous people, serving members of the Canadian Forces, eligible veterans, inmates in federal penitentiaries, and some groups of refugee claimants (14). Most provinces also provide limited public dental care benefits for those living in financially strained circumstances. Approximately 6% of Canadian annual dental expenditure comes from public funds, but the care is primarily delivered by private practitioners on a fee-for-service model.

Brazil offers the SUS, a public oral health care system that is universal and employs salaried dental professionals working in community clinics (usually referred to as Family Health Units) within primary health care services (15,16). Oral health care is delivered through a network of dentists and dental assistants and, in some cases, dental hygienists. When specialized care, including periodontal or endodontic treatment, is required, patients are referred to a specialized dental centre (CEO) for free care, administered by salaried dental professionals (16).

New Zealand offers free oral health care to children up the age of 18, delivered by either oral health therapists or dentists. Adults pay for care privately, in the form of out-of-pocket payments direct to the private provider. Treatment for no-fault dental trauma is provided by private dental practitioners and is funded at a fixed cost by the Accident Compensation Corporation, which also covers temporary visitors who have suffered personal injuries (17).

In Sweden, basic oral health care is paid for children and adolescents, while it is subsidised to those older than 21 years of age under a high-cost protection plan. Under this plan, patients receive a small fixed annual subsidy for examinations and preventive care, typically around \$34 USD for adults between 21 to 29 years of age and those older than 65, and \$17 USD for 30- to 64-year-olds (as per the exchange rate on October 10, 2017 at USD \$1 for SEK8.09). For other oral health care services within a 12-month period, patients older than 21 years of age pay the full cost of services up to \$371 USD (SEK3000), 50% of the cost for services between \$371 USD and \$1,854 USD (SEK15,000), and 15% of costs for services above \$1,854 USD. There is no cap on users' charges for oral health care, as the system is based on needs rather than on affordability—where those with greater care needs pay only part of the treatment cost (18).

The workforce

The available dental workforce likely influences access to dental care. In 2019, Brazil had 412 dental schools, Canada had 10, New Zealand had one, and Sweden had four; the dentist to population ratio in these countries also varies (Table 1). Despite the number of newly graduated dental professionals in these four countries, very few may want to pursue careers in dental public health in Canada (20); in Brazil, the public oral health care system employs the largest number of salaried dental professionals (15,16). Either way, the subsequent lack of strong leadership in public health has resulted in deteriorating support for oral health professionals who typically provide care for marginalized populations. For example, the Canadian National School of Dental Therapy was closed in November 2011 (21), even though Canada has historically relied heavily upon dental therapists to provide community-based care in Indigenous communities. Only New Zealand (22), and now Canada to a much lesser extent, continuously employs oral health therapists (a.k.a. dental nurses or dental therapists) as part of the dental workforce aimed to improve access to oral health care for children and adolescents (23). In Brazil, the development of the National Policy of Oral Health in 2004 placed access to oral health care within the national agenda (24), while dental hygienists experienced increased limitation in their scope of practice over the past 30 years. Interestingly, the scope of practice of dental hygienists in Canada and Sweden (17) is gradually expanding and those who can already practice independently can also provide interim stabilization and atraumatic restorative therapies. Regardless of the type of dental professional, workforce alone is likely insufficient to promote positive oral health outcomes and equitable access to oral health care.

Oral health outcomes

In the four countries studied, the percentage of the population utilizing oral health care services for any reason in a 12-month period varied, ranging from 44.4% in Brazil (25), 64.6% in Canada (26), 51.2% in New Zealand (27), to 87.4% in Sweden (28). The percentage of caries-free 12-year-old children was: 50% in Brazil; 61% in Canada; 45% in New Zealand; and 67% in Sweden. The percentage of edentulous adults between the ages of 20 and 79 in each country was: 6.4% in Canada, 9.6% in New Zealand, 0.8% in Sweden, and 6.5% in Brazil (Table 1). Despite the overall decrease in the incidence of dental decay in developed countries, profound oral health disparities may still exist based on gender, income, age,

accessibility and acceptability, and race/ethnicity; these are beyond the scope of this manuscript (29,31,32).

Discussion

This manuscript aimed at critically reviewing the oral health care systems of four different countries in terms of structure, scope, and the impact on oral health outcomes. Access to oral health care remains a major key in reducing the burden of oral diseases and improving the quality of life to (30). However, there is limited documentation as to what extent publicly-funded (i.e., universal) oral health care can lead to acceptable oral health outcomes (2). In the current study, utilization of services did not seem to depend on the actual availability of oral health care, for example, when comparing utilization rates in Brazil (44.4%) and Sweden (87.4%). Utilization does depend on many other factors other than availability, number of providers, or universality, including predisposing and enabling factors such as distribution and geographic location of the services, relevance of the services offered, and patients' preferences for providers they trust (31,32). Utilization of oral health care services also depends on health care policies, oral health behaviours, and self-perceived oral health status (3,6,24). None of these factors were explored in this study however.

Whether or not oral health care is universally offered, Saekel emphasizes that oral health can only be achieved "*if dentists take a less interventionist approach ... as treating dental diseases [and focus on] preventive and tooth-preserving methods*" (33). When asked about a positive aspect of the Brazilian public dental care system, a 32-year-old salaried dentist working at a CEO in Porto Alegre for 4 years mentioned this less interventionist way of treating patients:

"What I like about the CEO is that we receive the referral for a particular treatment so we know what we will be doing...we do not go beyond what was suggested by the other colleague just because the patient gets it all covered. We do what the patient needs and avoid doing what is not [needed]."

In Canada, where oral health care continues to be privately financed, administered, and delivered, one-third of Canadians remain without any form of dental coverage, while 64.6% of the population utilizes the services. Moreover, less than 6% of Canadians receive some form of universal coverage via government-sponsored dental plans (34). According to a 36-year-old junior faculty member from the Faculty of Dentistry in Western part of Canada, a potentially negative aspect of Canadian dental care is this discretionary aspect of the system:

"Perhaps if we, as a country, had the same priorities to serve all Canadians, things would be different. I mean, very few people have dental care from the government, especially the elderly. But I know of good dental public services to seniors in Alberta and to children in Ontario. It is unfortunately that we have to choose who to serve instead of treating them all the same way across."

For families living at, or below, the poverty line, out-of-pocket dental expenses are potentially catastrophic health expenditures. Disposable income is virtually non-existent in these households and so oral health

inequalities remain (35). Hence, low-income Canadians may rely on the availability of charitable or community dental clinics to have their needs addressed (2) or end up in hospital emergency rooms for dental pain relief (36). However, the availability of universal or subsidized oral health care does not imply that all individuals will obtain necessary treatment—given that other life priorities come into play, along with issues of dental fear and anxiety (37) and the array of other factors described above (31,32). Although Sweden pays for oral health care for children and adolescents, and subsidizes it for adults, a 45-year-old salaried dentist working for seven years at a dental clinic for low income Swedes told us that:

"If you look as an outsider, the Swedish dental system is almost perfect; you have free dental exams and the more you need in treatment, the less you pay yourself. But every patient here is different and some do not care if they can have that tooth fixed. They have other burning issues in life, survival is one of them, and in that case, a missing or a broken tooth does not get too much of their attention."

Ismail and Sohn (38) further highlighted that having access to universally-financed oral health care has to be understood within an array of other factors so that oral health disparities can be eliminated. In fact, in New Zealand, early childhood caries reduction has stagnated – despite free access to dental care for that age group. Such stagnation in caries reduction indeed points to extraneous factors, including poverty, social inequality, and sugar consumption, as strong players in dental caries development (39).

These observations are not just limited to children, studies involving older adults who receive medical and oral health care at a discounted cost still show a social gradient in utilization against the poor and the very old (40). With a large number of older adults keeping their natural teeth for life, a 52-year-old private practicing dentist (for 18 years) from Vancouver commented on the need for constant adaptation of the health care system:

"As a negative aspect, dental care is not universal in Canada. But if we did have one [public dental care system], it would have to change and adapt to the changes in disease patterns, particularly in older adults. When I started, there was a lot of need for rehabilitation in the form of removable and fix[ed] appliances, and that was a good financial return. Now, the seniors I see are keeping their natural teeth. Cleaning and restorative is the new norm, and cost much less; I make less. The dental system would have to adapt to that."

The robust Brazilian public oral health care system seems to be utilized more by those who are socio-economically disadvantaged and have a greater need for treatment, although it experiences less than 50% of overall use. Nationally, primary dental care coverage is still below 40% for Brazilians (41). Public oral health systems have yet to show their intended role in promoting positive oral health outcomes, and providing universal access to comprehensive oral care regardless of the number of dental professionals available. According to a 47-year-old Brazilian salaried manager working at a large public dental clinic for 21 years:

"Since Brazil introduced the CEO, we did see more patients coming through the system, but the numbers seem to have reached a plateau, and not everybody uses the services. But does this indicate a ceiling

effect in dental care attendance regardless of the availability of universal care? I'm not sure, but it looks like there are significant inequalities among various regions."

Swedish universal oral health care seems to be more equitable, as only about 7.7% of adults between the ages of 20 and 79 refrained from dental treatment for financial reasons in 2016 (42), while more than 80% of Swedes visited a dentist in a 1-year period (28,43). Interestingly, the attendance rate of Canadians (who do not benefit from universal oral health care) is almost 70%; however, many more Canadians (approximately 17%) do not get dental treatment due to financial reasons (33). Could this discrepancy between Canada and Sweden be a result of the system's failure to look after its citizens? Such accountability of a nation to its citizens was indeed an issue for a 26-year-old salaried oral health therapist in New Zealand's North Island who had been working for 5 years:

"I sometimes see myself running in circles. I see a young kid, usually from a low income family, with lots of dental disease and the parents want all done at once, under general anaesthesia at a hospital, which I refer. When I see this kid again with a more permanent dentition, the disease is still there, and there are no baby teeth left. Is our entire system that good that [it] may cover an expensive treatment at a hospital, and yet, fail to prevent the disease to happen again?"

Universal oral health care should be understood within a complex systems model, as suggested by Rutter and colleagues (44), in which "*poor health ... are outcomes of a complex multitude of interdependent elements within a connected whole*". These elements include patients' attitudes toward dentistry, living circumstances, self-perceived oral health, and dental fear and anxiety (36,45). Such complexity also precludes any definite direct causal link between universally-funded oral health care and oral health outcomes. For example, even though Brazil provides universal public oral health services while Canada does not provide dental coverage for most adult citizens, oral service utilization in Canada (64.6%) is higher than that of Brazil (44.4%) according to the available literature.

Although at differing levels, oral health outcomes in Canada, Sweden, New Zealand, and Brazil will probably not change without widespread commitment from government, dental professionals, stakeholders, and society at large. However, together with this combined commitment, Werhane (46) pointed out that "*morally ... a systemic approach has to take into account the multi-perspective dynamics involved in health care ... without ignoring the critical roles and responsibilities each of professionals, providers, payers, or patients*", which is a similar suggestion as that brought up recently by Rutter et al. (43). Although such systems thinking has yet to materialize in dentistry, "*oral health care should never be a choice between feeding your children and getting that front tooth fixed,*" said a 52 year-old Canadian private dentist from Vancouver.

It is undeniable that both the Swedish high cost-protection scheme and Brazilian publicly-funded oral health care tends to minimize or even eliminate affordability as a barrier. However, neither system has yet to fully eliminate oral health disparities – utilization rather than access remains a personal choice mediated by life circumstances, choices, and perceived benefits. Moreover, Leake (3) highlights that "*unless an alternative direction is taken, dentistry will lose its relevance as a profession working for the*

public good and this will be followed by further erosion of public support for dental education and research" regardless of undergraduate dental education's attempt to address dental public health (20), community services (47,48), and social responsibility (49) within its future workforce.

Sweden and Brazil are not the only countries to have adopted a more universal oral health care system (49). Austria, Denmark, Germany, Poland, Thailand, Spain, and Mexico provide basic oral health care services—either through government-sponsored or employment-based insurance—while the same care is delivered through a combination of subsidized private practitioners and government health services in Greece, Turkey, and Finland (50). Cuba, Chile, Colombia, Costa Rica, and other Latin-American countries offer free primary and specialized oral health care, mainly to children and mostly limited to school programs (51). However, there is an urgent need to evaluate the various oral health services through country-specific health care systems in terms of their ability to promote oral health outcomes and address oral health disparities regardless of age, gender, socioeconomic status, or health conditions (2,34). This study does not distinguish health care from oral health care: the mouth is part of the body and should be equally cared for. However, it is known that oral health care utilization is mediated differently from general health care utilization (52,53,54).

The limitations of this critical review assay likely include publication biases in terms of selection of the literature although attempts were made to identifying and including grey literature. Another limitation is the lack of a full systematic approach to identify the literature. There was also a lack of comparisons with countries that have no publicly-funded health care system and the use of convenient, informal limited number of interviews, without a proper and rigour qualitative methodology, to collect and analyze information from key informants even though they offered a first-hand account for an insider view of their respective oral health care systems. Furthermore, the use of DMFT and edentulism as outcome measures of oral health pose another limitation on this review given their inherit epidemiological disadvantages. This study did not gather data on the many other factors that are known to influence service utilization including age, gender, educational level, and so on. The countries' historical, political, social, and economic trajectories, which have greatly affected their oral health care systems were also not discussed. Lastly, the lack of a more uniform source of data to support the various statements made throughout this manuscript might have biased the information presented.

Conclusions

Despite having publicly-funded health care – albeit at differing levels – Brazil, Canada, New Zealand, and Sweden struggle to balance utilization and equitable provision of oral health care to all residents. Universal funding of oral health care helps to reduce economic barriers in assessing services. This critical and comparative review provides relevant information to academics, front-line workers, and policymakers by depicting various approaches used to finance, organize, and deliver oral health care services.

Abbreviations

CEO – Centro de Especialidades Odontologicas

DMFT – Decayed-Missing-Filled-Teeth

GDP – Gross Domestic Product

SUS – Sistema Unico de Saude

Declarations

Ethical approval and consent to participate: The University of British Columbia Researcher Information Services (RISe) Ethical Approval was obtained through H16-00735. Consent to participate was obtained verbally. The datasets used and analyzed during the current study are available upon request.

Consent for publication: Not applicable

Availability of data and materials: Most of the data generated and analyzed during this study (e.g., findings from the literature review) are included in this published article. The full list of 79 publications are available from the corresponding author upon request.

Competing interests: The authors declare no conflict of interest and have consented to have the manuscript submitted for publication.

Funding: Not applicable

Authors' contributions: MAB conceptualized the study, and drafted and edited the manuscript; KMM contributed to the information pertaining to the Canadian health care system; GES and PS contributed to the information pertaining to the health care system in Sweden; MS and WMT contributed to the information pertaining to the New Zealand health care system; TA and FH contributed to the information pertaining to the health care system in Brazil.

Acknowledgments: The authors are thankful to all those who volunteered information and gave their insights into their respective oral health care systems. This manuscript was based on a poster presented during the September 2017 conference of the Canadian Association of Public Health Dentistry in Toronto, Canada.

References

[1] Mathur MR, Williams DM, Reddy KS, Watt RG. Universal health coverage: a unique policy opportunity for oral health. *J Dent Res.* 2015;94(3 Suppl):3S-5S.

[2] Wallace BB, MacEntee MI, Pauly B. Community dental clinics in British Columbia, Canada: examining the potential as health equity interventions. *Health Soc Care Community.* 2015;23(4):371-9.

- [3] Leake J. Why do we need an oral care policy in Canada? *J Can Dent Assoc.* 2006;72(4):317.
- [4] Sheiham A. Public dental health: Is there an inverse 'dental' care law? *Brit Dent J.* 2001;190:195.
- [5] Brondani M, Wallace B, Donnelly L. Dental insurance and treatment patterns – implications to oral health outcomes. *J Can Dent Assoc* 2019; 85: j10.
- [6] Neumann DG, Quinonez C. A comparative analysis of oral health care systems in the United States, United Kingdom, France, Canada, and Brazil. *NCOHR Working Papers Series* 2014;1:2. [accessed 2017 October 29] <http://ncohr-rccrsb.ca/knowledge-sharing/working-paper-series/content/garbinneumann.pdf>
- [7] Kandelman D, Arpin S, Baez RJ, Baehni PC, Petersen PE. Oral health care systems in developing and developed countries. *Periodontol 2000.* 2012;60(1):98-109.
- [8] Organisation for Economic Co-operation and Development. Universal Health coverage and health Outcomes. Final Report. Paris, 22 July 2016. [accessed 2018 May 24] <https://www.oecd.org/els/health-systems/Universal-Health-Coverage-and-Health-Outcomes-OECD-G7-Health-Ministerial-2016.pdf>
- [9] Health Canada. Canada Health Act Annual Report 2012-2013. Ottawa: Minister of Health of Canada. 2013.
- [10] Ministério da Saúde. Secretaria Executiva Sistema Único de Saúde (SUS): princípios e conquistas / Ministério da Saúde, Secretaria Executiva. Brasília: Ministério Saúde, 2000.
- [11] Forum da Reforma Sanitaria. SUS pra valer: universal, humanizado e de qualidade. *Saude Debate.* 2006;29(31):385-96.
- [12] Gauld R. What Should Governance for Integrated Care Look Like? New Zealand's Alliances Provide Some Pointers. *Med J Australia.* 2014;201(3):s67–68.
- [13] Anell A, Glenngår, AH, Merkur S. Sweden: Health System Review. *Health Systems Tran.* 2012;14(5):1–161.
- [14] Quiñonez C, Locker D, Sherret L, Grootendorst P, Azarpazhooh A, Figueiredo R. An environmental scan of publicly financed dental care in Canada. 2005. Community Dental Health Services Research Unit and Office of the Chief Dental Officer, Health Canada.
- [15] Haddadl AE, Morita MC, Pierantoni CR, Brenelli SL, Passarella T, Campos FE. Formação de profissionais de saúde no Brasil: uma análise no período de 1991 a 2008. *Rev Saúde Pública* 2010;44(3):385-93.
- [16] Cascaes AM, Dotto L, Bomfim RA. Tendências da força de trabalho de cirurgiões-dentistas no Brasil, no período de 2007 a 2014: estudo de séries temporais com dados do Cadastro Nacional de Estabelecimentos de Saúde. *Epidemiol. Serv. Saude, Brasília,* 27(1):e201723615, 2018

- [17] Pucca GA Jr, Gabriel M, de Araujo ME, de Almeida FC. Ten Years of a National Oral Health Policy in Brazil: Innovation, Boldness, and Numerous Challenges. *J Dent Res.* 2015;94(10):1333-7
- [18] Public Act. Accident Compensation Act 2001. No 49. 19 September 2001. Act name: substituted, on 3 March 2010, by section 5(1)(a) of the Accident Compensation Amendment Act 2010.
- [19] The Common Wealth Fund. [accessed 2018 May 19]
<http://international.commonwealthfund.org/countries/sweden/>
- [20] Brondani M, Pattanaporn K, Aleksejuniene J. How can dental public health competencies be addressed at the undergraduate level? *J Public Health Dent.* 2014;75(1):49-57.
- [21] Nash DA, Friedman JW, Kardos TB, Kardos RL, Schwarz E, Satur J, Berg D, Nasruddin J, Mumghamba EG, Davenport ES, Nagel R. Dental Therapists: a global perspective. *International Dent J.* 2008;58:61-70.
- [22] Moffat S M, Coates D E, Meldrum A M. New Zealand's changing oral health workforce. A dental practitioner's guide to dual-trained dental therapists/dental hygienists. *N Z Dent J.* 2009;105:5761
- [23] Friedman JW, Mathu-Muju KR. Dental Therapists: Improving Access to Oral Health Care for Underserved Children. *Am J Public Health.* 2014;104(6): 1005–1009.
- [24] Reinders JJ, Krijnen WP, Onclin P, van der Schans CP, Stegenga B. Attitudes among dentists and dental hygienists towards extended scope and independent practice of dental hygienists. *Int Dent J.* 2017;67(1):46-58.
- [25] Stopa SR, Malta DC, Monteiro CN, Szwarcwald CL, Goldbaum M, Cesar CLG. Use of and access to health services in Brazil, 2013 National Health Survey. *Rev Saude Publica.* 2017;51(Suppl 1):3s.
- [26] Canadian Dental Association. The State of Oral Health in Canada. [accessed 2018 May 19].
https://www.cda-adc.ca/stateoforalhealth/_files/TheStateofOralHealthinCanada.pdf
- [27] The Organisation for Economic Co-operation and Development. *Health at a Glance 2011: OECD Indicators.* France: OECD Publishing; 2011. [accessed 2018 May 19]. Available:
<http://www.oecd.org/els/health-systems/49105858.pdf>
- [28] Stahlnacke K, Soderfeldt B, Unell L, Halling A, Axtelius B. Changes over 5 years in utilization of dental care by a Swedish age cohort. *Community Dent Oral Epidemiol.* 2005;33:64–73.
- [29] Drummond AMA, Ferreira EF, Gomes VE, Marques W. Inequality of Experience of Dental Caries between Different Ethnic Groups of Brazilians Aged 15 to 19 Years. *PLoS One.* 2015;10(12):e0145553.
- [30] Shihipar S. Dental care is a right, not a luxury. *The Globe and Mail.* 2017. [accessed 2018 May 19].
<https://www.theglobeandmail.com/opinion/dental-care-is-a-right-not-a-luxury/article35776626/>

- [31] Jessani A, Aleksejuniene J, Donnelly L, Phillips JC, Nicolau B, Brondani M. Dental care utilization: patterns and predictors in persons living with HIV in British Columbia, Canada. *J Public health Dentistry*. <https://doi.org/10.1111/jphd.12304>
- [32] Jessani A, Laronde D, Mathu-Muju K, Brondani MA. Self-Perceived Oral Health and Use of Dental Services by Pregnant Women in Surrey, British Columbia. *J Can Dent Assoc*. 2016;82:g28
- [33] Saekel R. China's oral care system in transition: lessons to be learned from Germany. *Int J Oral Sci*. 2010;2(3):158-76.
- [34] Health Canada. Report on the findings of the oral health component of the Canadian Health Measure Survey 2007-09. [accessed 2017 May 19] http://publications.gc.ca/collections/collection_2010/sc-hc/H34-221-2010-eng.pdf
- [35] Bernabé E, Masood M, Vujicic M. The impact of out-of-pocket payments for dental care on household finances in low and middle income countries. *BMC Public Health*. 2017;17(1):109.
- [36] Brondani MA, Syed HA. The 1% of emergency room visits for non-traumatic dental conditions in British Columbia: (mis)understanding the numbers. *Canadian J Public Health*, 2017;108(3):e279-e281.
- [37] Berggren U, Meynert G. Dental fear and avoidance: causes, symptoms, and consequences. *J Am Dent Assoc*. 1984;109(2):247-25
- [38] Ismail AI, Sohn W. The impact of universal access to dental care on disparities in caries experience in children. *J American Dent Assoc*. 2001;132(3):295–303.
- [39] Gimenez T, Bispo BA, Souza DP, Vigano ME, Wanderley MT, Mendes FM, Bönecker M, Braga MM. Does the Decline in Caries Prevalence of Latin American and Caribbean Children Continue in the New Century? Evidence from Systematic Review with Meta-Analysis. *PLoS One*. 2016; 11(10):e0164903.
- [40] Lewis DW, Thompson GW. Alberta's universal dental plan for the elderly: differences in use over 6 years by two cohorts. *Am J Public Health*. 1995;85(10):1408-11.
- [41] Baldanil MH, Antunes JL. Inequalities in access and utilization of dental services: a cross-sectional study in an area covered by the Family Health Strategy. *Cad Saúde Pública*. 2011;27(2):S272-S283.
- [42] Molarius A, Engström S, Flink H, Simonsson B, Tegelberg A. Socioeconomic differences in self-rated oral health and dental care utilisation after the dental care reform in 2008 in Sweden. *BMC Oral Health*. 2014;14:134.
- [43] Tillståndet och utvecklingen inom hälso- och sjukvård – Lägesrapport. 2017 [Status and development within health care] [accessed 2017 October 17] <http://www.socialstyrelsen.se/publikationer2017/2017-3-1>

- [44] Rutter H, Savona N, Glonti K, Bibby J, Cummins S, et al. The need for a complex systems model of evidence for public health. *Lancet*. 2017;390(10112): P2602-2604,
- [45] Beaudette JR, Fritz PC, Sullivan PJ, Ward WE. Oral Health, Nutritional Choices, and Dental Fear and Anxiety. *Dent J*. 2017;5:8.
- [46] Werhane PH. Access, responsibility, and funding: A systems thinking approach to universal access to oral health. *J Dent Educ*. 2006;70(11):1184-95.
- [47] Brondani MA, Clark C, Rossoff L, Aleksejūnienė J. An evolving community based dental course on Professionalism and Community Service. *J Dent Educ*. 2008;72:1160-1168.
- [48] Furlini L, Noushi N, Castonguay G, Allison P, Bedos C, De Souza R, Esfandiari S, Hovey R, Macdonald ME, Morris M, Nicolau B, Power F, Feine J. Assessing Dental Students' Readiness to Treat Populations That Are Underserved: A Scoping Review. *J Dent Educ*. 2018;82(5):483-491.
- [49] Brondani MA. Teaching social responsibility through community service-learning in predoctoral dental education. *J Dent Educ*. 2012; 76:609-619.
- [50] Council of European Dentists: Manual of Dental Practice 2015 [accessed 2017 October 17]
<https://tandlakarforbundet.se/app/uploads/2017/01/ced-dentistry-in-sweden-2015.pdf>
- [51] Paris V, Devaux M, Wei L. Health Systems Institutional Characteristics: a survey of 29 OECD countries. *OECD Health Working Papers*. 2010;50. Paris: OECD Publishing; [accessed 2018 May 24].
<https://www.wbginvestmentclimate.org/toolkits/public-policy-toolkit/upload/OECD-Survey.pdf>
- [52] Adekanmbi VT, Adedokun ST, Taylor-Phillips S, Uthman AO, Clarke A. Predictors of differences in health services utilization for children in Nigerian communities. *Prev Med*. 2017; 96:67-72.
- [53] Lutfiyya MN, Gross AJ, Soffe B, Lipsky MS. Dental care utilization: examining the associations between health services deficits and not having a dental visit in past 12 months. *BMC Public Health*. 2019; 19(1):265.
- [54] Manski RJ, Magder LS. Demographic and socioeconomic predictors of dental care utilization. *J Am Dent Assoc*. 1998; 129(2):195-200.

Tables

Table 1 – Gross domestic product and per capita, GINI index, health and oral health expenditure, number of dental schools, dental workforce, and oral health outcomes in Brazil, Canada, New Zealand and Sweden

	Brazil	Canada	New Zealand	Sweden
GDP ranking ^a	\$1.79 trillion (9 th)	\$1.53 trillion (10 th)	\$153 billion (53 rd)	\$511 billion (22 nd)
GDP per capita ranking ^b	\$15,242 (80 th)	\$46,437 (22 nd)	\$37,294 (31 st)	\$49,836 (15 th)
GINI index ^c	52.87 (13 th)	33.68 (107 th)	36.20 (83 rd)	27.32 (144 th)
Healthcare expenditure, from most recent available ^d	8.3d	10.4	11.0	11.9
Health expenditure (% of the GDP) ^e	0.2	0.8	N/A	0.77
Number of dental schools ^f	232	10	1	4
Number of dentists per 1,000 population ^g	115	58	60	80
Dental professionals ^h	-Dental Auxiliary, -Dental laboratory technicians	-Dental hygienists, -Certified dental assistants, -Oral health therapists -Denturists -Dental technicians	-Dental hygienists, -Dental assistants, -Oral health therapists -Dental technicians	-Dental hygienists, -Dental nurses

Oral Health Measures

Oral health measures ⁱ	50	61	45	67
Oral health measures ^j	6.5	6.4	9.6	0.8

a Gross Domestic Product as per the International Monetary Fund in 2016, in US\$.

b Gross Domestic Product per capita as per the International Monetary Fund in 2016, in US\$0. c It measures the extent to which the distribution of income among individuals or households within a country deviates from a perfectly equal distribution, and it varies from 0, representing a perfect equality to 100, representing a perfect inequality. From World Bank Estimate.

d This is total expenditure: public expenditures are approximately 4% and the remaining is from direct expenditures by individuals and families.

e There is variation in terms of definition and scope of practice of these professions. In Canada, while dental hygienists perform scaling and root planing and can work independently in some jurisdictions, in Brazil they cannot work independently. An oral health therapist in New Zealand is able to provide restorative and preventive care for children and adolescents until the age of 18, and preventive care (including scaling) for those aged 18 or over.

Table 2 – Summary points from the key informants' interviews

would be a positive and a negative aspect of your oral health care delivery system?*

	Positive aspects	Negative aspects
ed dentist at CEO ^{pl} , 32 yrs old ed manager at ¹ for 21 yrs, 47 yrs e practice dentist 5 yrs, 49 yrs old	<ul style="list-style-type: none"> • The service we provide is more focused, avoid unnecessary treatment • Team work, camaraderie • Dental care is available to everyone 	<ul style="list-style-type: none"> • Long waiting time for patients to see a specialist • Plateau of service delivery; not everybody utilizes the services • Too many dentists competing for the same pool of patients and jobs
la ersity academic for , 36 yrs old te practice dentist 8yrs, 52 yrs old ed administrator at ncommunity clinic for s, 48 yrs old	<ul style="list-style-type: none"> • Encourage the profession to advocate for dental care • Focus on some Canadians who have the most needs • A guaranteed pool of patients 	<ul style="list-style-type: none"> • Very few people with government oral care funding • If universal, oral health care would have to adapt to the change in disease pattern • Some patients with public benefits are not seen by all dentists
Zealand ied oral health apist for 5 yrs, 26 ld ersity academic for s, 38 yrs old i administrator at a ol-based program yrs, 37 yrs old	<ul style="list-style-type: none"> • Comprehensive dental services under GA[^] at a hospital • Focus on children and adolescents when they need to most • Provision of care by oral health therapists and dentists 	<ul style="list-style-type: none"> • Failure to prevent disease from happening • Adults are left without coverage • The prevalence of dental decay has plateaued in children, but still a concern

<p>en ed dentist at a , 45 ld, 7 yrs on the job</p> <p>rsity academic, 48 ld, 20 yrs on the</p> <p>e practice dentist 2yrs, 49 yrs old</p>	<ul style="list-style-type: none"> • The more you need, the less you pay; access to services depend on priorities • Oral care is based on needs rather than affordability • The overall idea of prevention is widespread 	<ul style="list-style-type: none"> • Oral care might not be a priority to some • The profession itself is not as regulated as in other countries • Workforce availability in remote areas is not ideal
---	---	---

* All key informants were currently working on their respective jobs

¹ Specialized dental center (CEO - Centro de Especialidades Odontologicas)

^{II} Unified Health System (SUS - Sistema Único de Saúde)

[^] General Anesthesia

Figures

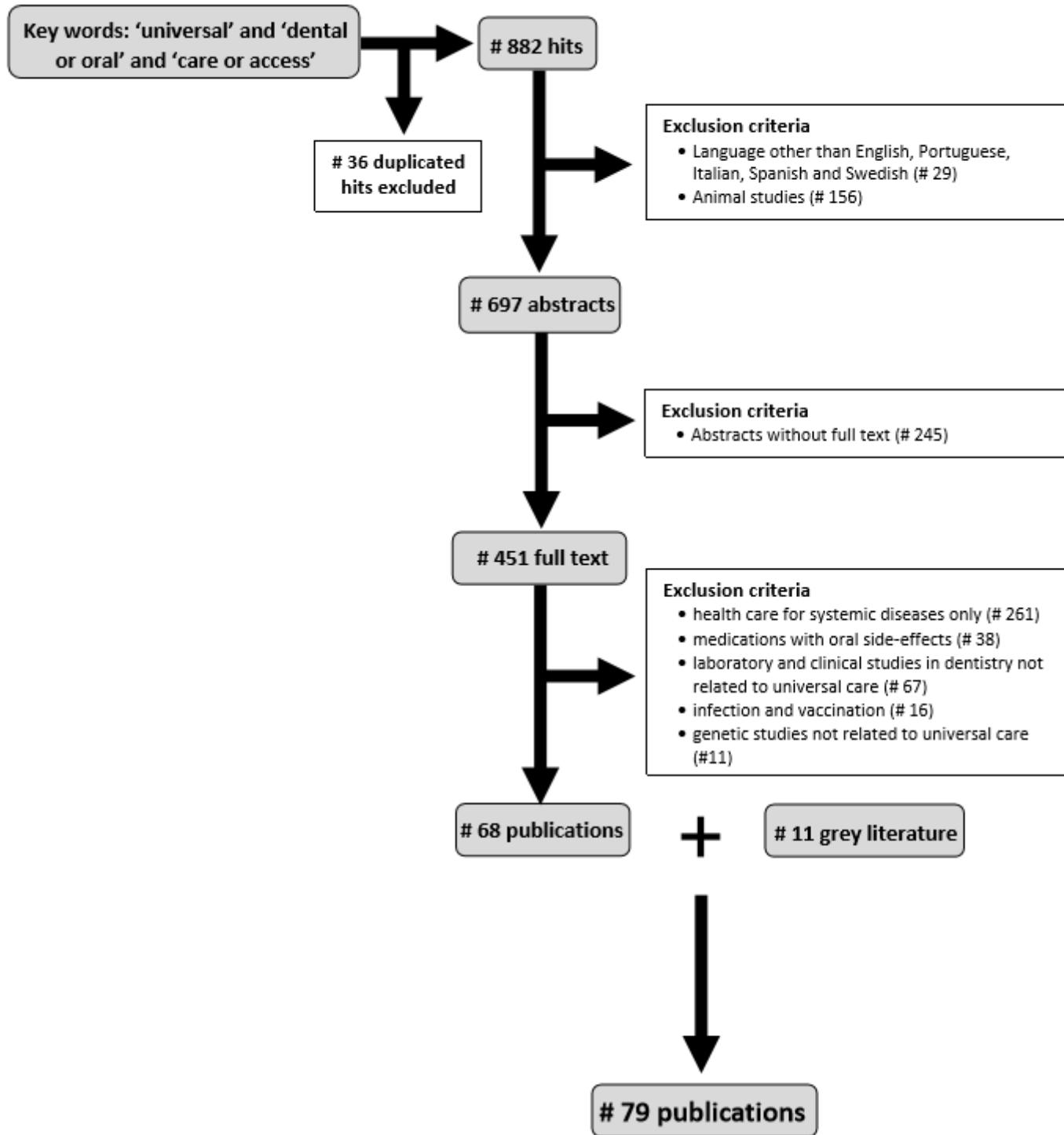


Figure 1

Searching strategy for the 79 selected publications