

Comparing Hospital-Based Dental Care Between Individuals with and Without Developmental Disabilities in Manitoba: A Population-Based Study

Abstract

The main objective of the present study was to compare the use of hospital-based dental care between persons with and without developmental disabilities (DD) in Manitoba. Five years of linked administrative data were used to identify persons with DD. Each DD case was matched with two controls based on age, sex and place of residence. The procedures labelled as hospital-based dental care included: surgical extraction of tooth, restoration of tooth by filling or other, and dental scaling, polishing and debridement. We found that 1.78% of the matched comparison group experienced at least one episode of hospital-based dental care over the study period. Among the group with DD, 13.95% had such a history. There was a significant difference in the average number of hospitalizations for dental care between the two groups ($t = -23.28$, $df = 5824$, $p < 0.0001$). Oral health care for persons with DD should be considered as a priority for training, practice and research.

Hospital-based dental care plays an important role in the provision of dental care in Canada. According to the Canadian Dental Association (CDA), one of the main purposes of hospital dentistry is to "meet the needs of special patient populations who face barriers to accessing oral health care in the private dental office setting." (Canadian Dental Association (CDA), 2013). Among these "special patient populations" are individuals with developmental disabilities (DD). Persons with DD are those who have significantly greater difficulty than most people with intellectual and adaptive functioning and have had such difficulties from a very early age (National Coalition on Dual Diagnosis, n.d.).

The oral health treatment needs of persons with DD have been shown to be greater than those without disability. The literature suggests that persons with DD experience similar rates of dental caries compared to the general population (Gabre & Gahnberg, 1997; Hennequin, Faulks, & Roux, 2000) but that the prevalence of untreated caries is higher, making extractions a more common method of treatment compared to restorative care (Allison, Hennequin, & Faulks, 2000; Allison & Lawrence, 2004; Tiller, Wilson, & Gallagher, 2001). Persons with DD are also less likely to receive preventative care for caries (Allison & Lawrence, 2004; Kaye, Fiske, Bower, Newton, & Fenlon, 2005). These discrepancies in oral health have been attributed to many factors, including a lack of manual dexterity to maintain oral hygiene among per-

Authors

Shahin Shooshtari,¹
Marni Brownell,²
Hélène Ouellete-Kuntz,³
C.T. Yu,⁴ Saba Naghipur,⁵
Brian Hennen,⁶
Beverley Temple,⁷
Natalia Dik,⁸ Charles Burchill,⁸

¹ Dept. of Family Social Sciences,
Faculty of Human Ecology,
University of Manitoba &
St. Amant Research Centre, MB

² Dept. of Community Health
Sciences; Manitoba Centre for
Health Policy, University of
Manitoba, MB

³ Dept. of Public Health Sciences,
Queen's University & Ongwanada
Resource Centre, ON

⁴ Dept. of Psychology, Faculty of
Arts, University of Manitoba &
St. Amant Research Centre, MB

⁵ Faculty of Dentistry, University
of Manitoba, MB

⁶ Dept. of Family Medicine,
Faculty of Medicine, University
of Halifax, NS

⁷ Faculty of Nursing, University of
Manitoba & St. Amant Research
Centre, MB

⁸ Manitoba Centre
for Health Policy,
University of Manitoba, MB

Correspondence

Shahin.Shooshtari@
umanitoba.ca

Keywords

hospital-based dental care,
administrative data,
developmental disability,
data linkage

sons with disability, the attitudes of caregivers and dental professionals and the availability and affordability of dental services (Burtner & Dicks, 1994; Casamassimo, Seale, & Ruehs, 2004; Fenton, Hood, Holder, May, & Mouradian, 2003; Koneru & Sigal, 2009)

Many persons with DD are treated in private dental offices, but many also require the use of hospital-based dental services. A 2004 study from Ontario demonstrated that 40% of day admissions to hospital among people with intellectual disabilities were related to dental disease (Balogh, Ouellette-Kuntz, & Hunter, 2004). Some studies suggest the high rates of admissions can be attributed to the fact that many patients with DD, especially those with severe disability, can present with complex underlying medical conditions or demonstrate uncooperative behaviours, which often necessitates the use of general anesthesia to manage (Ananthanarayan, Sigal, & Godlewski, 1998; Hulland & Sigal, 2000). Other studies have also shown that dental care in private clinics can be inaccessible to patients with DD, as many general dentists may be reluctant to take on these patients, citing issues related to loss of time and poor remuneration, the potential for difficult behavior, lack of specialized equipment and facilities, and inadequate training (Ferguson, Berentsen, & Richardson, 1991). Only those dentists with training in providing care to patients with disabilities, either through their dental education or from specialized training, are likely to be comfortable and willing to treat such patients in private practice (Waldman, Fenton, Perlman, & Cinotti, 2005). As a result, seeking dental treatment through a hospital dental service may be the only viable option for these patients.

While hospital dental services may act as a safety net for those whose needs cannot be met in the community, there are caveats to seeking these services. Due to reduced funding in recent years, many hospital dental departments have experienced reductions in available operating room time and resources, creating longer wait lists for these services. This has also resulted in a decrease in the number of hospital dental residencies positions available, with some programs reducing their positions by as much as half (Park & Sigal, 2008). The costs associated with providing hospital care

for routine dental procedures as compared to the equivalent procedures in the dental office setting are also much higher, placing further stress on these departments (Griffin, Gooch, Beltran, Sutherland, & Barsley, 2000; Schroth & Morey, 2007).

The extent to which hospital-based dental care is used by persons with DD in Manitoba (Canada) is not well understood. The purpose of this study was to examine the use of hospital-based dental care among persons with DD in Manitoba, compared to an age- and sex-matched comparison group without DD. To date, no other study has examined the use of hospital dental services by Manitobans with DD.

Methods

Setting

The province of Manitoba has a population of 1.25 million, making it the 5th largest Canadian province/territory (Statistics Canada, 2014). Hospital services in Manitoba fall under the jurisdiction of the provincial government, which administers a universal health care plan that covers medically necessary physician and hospital services, including certain surgical-dental services. Dental services provided outside hospital settings are not included under this plan and individuals must cover the cost of these services, either through private insurance or out-of-pocket payment. In Manitoba, people who have a limited income and no private dental insurance (e.g., persons with DD), may access dental services offered at several community clinics in Winnipeg. For example, the University of Manitoba Faculty of Dentistry provides dental community services to meet the needs of the underserved populations including those with DD.

Data Sources

This study is based on data collected from five fiscal years (from April 1, 1998, to March 31, 2003) from multiple administrative databases contained in the Manitoba Population Health Research Data Repository (hereafter, the Repository). The Repository, housed and maintained by the Manitoba Centre for Health Policy

(MCHP) at the University of Manitoba, contains a comprehensive collection of anonymized but linkable health and non-health administrative databases covering all Manitoba residents. The administrative data sets used included the *Manitoba Population Registry*, *Hospital Abstracts database*, *Physician Claims database*, *Education Enrolment database*, and *Social Assistance Management Information Network (SAMIN) database*. All individuals registered in the provincial health care program are assigned a nine digit Personal Health Identification Number (PHIN). MCHP uses an encrypted, scrambled version of the PHIN as the consistent non-identifying research number, which permits researchers to link data across data files and track individuals over time while ensuring confidentiality (MCHP, 2013). The clinical information in the Hospital Abstracts uses the ICD-9-CM (the International Classification of Diseases – 9th Revision – Clinical Modification), codes up to 16 diagnoses and 12 surgical procedures (World Health Organization, 1977). This study searched all hospital discharge codes when looking for a diagnosis, or procedure. The clinical information on physician claims includes only one diagnosis coded using ICD-9-CM.

Case Definition

Using data from the Repository, we identified all persons living with a DD (i.e., cases) in Manitoba during the five-year study period from April 1, 1998 to March 31, 2003. Individuals who met at least one of the following three criteria were classified as DD cases: (1) received income assistance for reasons of ID, or multiple handicap from Manitoba Department of Family Services and Labour; (2) received special education funding from Manitoba Department of Education for reasons of multiple handicaps, usually defined as ID plus one or more physical disabilities; (3) had at least one ICD diagnostic code for ID and/or ASDs in either the physician claims or the hospital abstracts database.

Study Population

Using the above criteria, we identified a total of 5,378 individuals with DD (study cohort). Of these, 3,280 (or 61%) were males and 2,098 (or 39%) were females.

DD cases were then matched by sex, age (year of birth) and three-digit postal code, using a ratio of 1:2. We matched for age, since persons with DDs are found to be a much younger population than the non-DD population and we matched for sex, as research shows that a higher proportion of persons with DD are males than females (Ouellette-Kuntz et al., 2009). We also matched the two study groups based on place of residence, since research shows that this affects individuals' access to health care services (Martens et al., 2003). The total number of individuals in the comparison group was 10,756. The distribution of study subjects by age group, sex, and health region of residence is shown in Table 1.

We based the analyses presented in this paper on data for those with DD ($n = 5,378$) and their matched comparison group ($n = 10,756$).

Study Measures and Approach

We determined the use of hospital dental services using ICD diagnostic codes from the Hospital Abstracts database, using five years of data – 1998/1999 to 2002/2003. The three procedures of focus labeled as “hospital-based dental care” in this study included the following: (1) surgical extraction of tooth (ICD-9 of 23.09 & 23.19), (2) restoration of tooth by filling or other (ICD-9 of 23.2), and (3) dental scaling, polishing and debridement (ICD-9 of 96.54).

We examined three measures of hospital-based dental care. First we analyzed the proportion of each study group who had at least one episode of *hospital-based dental care*. Second, we examined the *average number of hospitalizations for dental care per population*. Third, we examined the *frequency of hospitalizations for dental care per person* in each study group.

Data Analysis

Descriptive analyses were conducted to compare hospital-based dental care during the study period for DD cases and the matched comparison group. Moreover, we conducted statistical tests including t-test and Chi-square (X^2) tests to determine significant differences in hospital-based dental care utilization between DD cases and their matched comparison group.

Programming and data analyses were performed using SAS ® software, version 9.1.

Table 1. Distribution of Study Subjects by Age Group, Sex, and Health Region of Residence

Characteristics	DD group (%)		Matched comparison group (%)	
Sex				
Male	3,280	(61.0)	6,561	(61.0)
Female	2,098	(39.0)	4,195	(39.0)
Age				
0-4	1,089	(20.3)	2,178	(20.3)
5-9	1,049	(19.5)	2,098	(19.5)
10-14	825	(15.3)	1,650	(15.3)
15-19	483	(9.0)	966	(9.0)
20-24	226	(4.2)	452	(4.2)
25-34	458	(8.5)	916	(8.5)
35-44	497	(9.2)	994	(9.2)
45-54	363	(6.8)	726	(6.8)
55-64	199	(3.7)	398	(3.7)
65+	189	(3.5)	378	(3.5)
Health region of residence				
Central	413	(7.7)	834	(7.8)
North Eastman	154	(2.9)	292	(2.7)
South Eastman	277	(5.2)	561	(5.2)
Interlake	325	(6.0)	988	(9.2)
Nor-Man	118	(2.2)	246	(2.3)
Parkland	217	(4.0)	428	(4.0)
Burntwood/ Churchill	266	(5.0)	560	(5.2)
Brandon	262	(4.9)	518	(4.8)
Assiniboine Winnipeg	245	(4.6)	490	(4.6)
Assiniboine Winnipeg	3,093	(57.5)	5,829	(54.2)
Total	5,378		10,756	

Ethics

The University of Manitoba Health Research Ethics Board, the Health Information Privacy Committee (HIPC) of Manitoba Health, Department of Family Services and Labour, and the Manitoba Department of Education approved this research.

Results

We found that of the 10,756 in the non-DD group, 191 of them had at least one hospitalization for dental care over the study period (1998/99-2002/03). This translates into 1.78% of the population receiving hospital-based dental care. Of

the 5,378 individuals in the DD group, a much higher number (750) of individuals received hospital-based dental care over the same time period. In other words, 13.95% of the population with DD received hospital-based dental care over the study period (see Table 2). The results of the χ^2 test indicated that the difference in proportion of the DD cohort and the matched comparison group was statistically significant.

Data were further analyzed to examine the age and sex distribution of those who received hospital-based dental care among the DD and non-DD populations. As shown in Table 3, there was a statistically significant difference between the cases and controls who received hospital-based dental care in terms of their age [$\chi^2 = 191.6289$, $df = 9$, $p < .0001$]. The majority of non-DD group

Table 2. Hospital-Based Dental Care, 1998/1999–2002/2003

Study population	Number of individuals with at least one episode of hospital-based dental care	% of population with at least one episode of hospital-based dental care
DD group (Total N = 5,378)	750	13.95
Matched comparison group (Total N = 10,756)	191	1.78

Table 3. Distribution of Study Subjects with at Least one Episode of Hospital-Based Dental Care by Age Group, 1998/1999–2002/2003.

Age Group	DD group (%)	Matched comparison group (no DD) (%)
0–4	25.10	77.50
5–9	19.70	12.00
10–19	21.20	5.80
20+	33.50	4.60
Total	100.00	100.00

who received hospital-based dental care (77.5%) were children under the age of five, 12% were between the ages of 5 and 9, and the remaining 10.5% were between the ages of 10 and 64. There was no one aged 65 or older who received hospital-based dental care during the study period among the Non-DD group. Of the 750 individuals with DD who received hospital-based dental care, 25.1% were under the age of five; 19.7% were between the ages of 5 and 9; about 21% were between the ages of 10 and 19; and more than one third (33.5%) were adults aged 20+.

Among the DD group who received hospital-based dental care, a significantly higher proportion were females than the Non-DD group who received hospital-based dental care [$X^2 = 5.6789$, $df = 1$, $p < .0172$].

Next, we examined the hospital-based dental care received by health region of residence. As shown in Table 4, about 61% of DD cases who received hospital-based dental care were residing in the urban health regions of Winnipeg and Brandon. The remaining 39% were living in rural health regions in Manitoba. Among the matched non-DD group who received hospital-based dental care, the majority (over 63%) resided in rural

health regions in Manitoba. The observed difference between the two study groups was statistically significant [$X^2 = 91.0526$, $df = 9$, $p < .0001$].

Next, we examined the average number of dental-related hospitalizations per study group. The average number of hospitalizations for the non-DD group was 0.0203. The average number of hospitalizations for the DD group was 0.1487. Results of t-test showed a significant difference in the average number of hospitalizations for dental care between the two groups [$t = -23.28$, $df = 5824$, $p < 0.0001$]. Another important finding was the number of different hospital episodes for dental care, which in the DD cohort ranged between 0 and 6. For the matched comparison group, the number of hospitalizations ranged between 0 and 2 (see Table 5).

Discussion

The present study was the first population-based comparative study to examine the use of hospital-based dental care between persons with and without DD in Manitoba. Using linked data from multiple administrative databases, we were able to identify a total of 5,378 individuals of all ages with DD, and those who

Table 4. Distribution of Study Subjects, Who Had at Least One Episode of Hospital-Based Dental Care by Health Region of Residence, 1998/1999–2002/2003

Health region of residence	DD group (%)	Matched comparison group (no DD) (%)
Central	7.70	7.90
N. Eastman	4.00	5.20
S. Eastman	5.70	3.70
Interlake	6.80	7.30
Nor-Man	2.70	11.00
Burntwood/Churchill	6.80	24.60
Brandon	3.90	4.20
Winnipeg	56.90	32.50
Total	94.5	96.4

*Note: data from Parkland and Assiniboine suppressed due to small cell size

Table 5. Frequency of Hospital-Based Dental Care per Person, 1998/1999–2002/2003

Quintile	DD group	Matched comparison group (no DD)
100%	6	2
99%	2	1
95%	1	0
90%	1	0
0–75%	0	0

received hospital-based dental care between 1998/1999 and 2002/2003. Proportion of the DD population, who received hospital-based dental care, was then compared with the proportion of the population in the matched comparison group, which consisted of 10,756 individuals.

One of the strengths of this study was the use of population-based data from the MCHP Population Health Research Data Repository. Researchers have used the Repository extensively for population-based research and the quality of data has been evaluated as high, based on criteria such as the completeness of the data sets and the accuracy of the information recorded (Brownell et al., 2002; Robinson & Tataryn, 1997; Roos & Nicol, 1999; Roos, Nicol

& Cageorge, 1987; Roos & Shapiro, 1999). One of the advantages of using these databases was the ability to use unique identifiers to link records, enabling the identification of a large number of individuals with DD across several data sets, as well as those who accessed hospital dental services, without duplication. Using multiple databases, this study identified 5,378 Manitobans with a DD over the 5-year study period. This represents 0.47% of the Manitoba population (based on 2001 population), which concurs with studies on the prevalence of DD in other Canadian provinces (Morgan, Zahir, & Kerr, 2000; Balogh, Hunter, & Ouellette-Kuntz, 2005). Another strength of this study was the length of the study period (5 years), which provided a more representative account of hospital usage in the province. Finally, the DD cases were matched with persons without DD based on age, sex, and place of residence for a more accurate and fair comparison.

Overall, we found a significantly higher rate of hospital-based dental care for persons with DD (13.95%) compared to the matched non-DD population (1.78%) over the five-year study period. More specifically, we found that the prevalence of hospital-based dental care (i.e., proportion of population with at least one episode of hospitalization for dental care) was nearly 8 times higher in the DD population than the matched non-DD population. The average number of hospital epi-

sodes for dental care per person in the DD group was also significantly higher than the matched comparison group (0.1487 vs. 0.0203). This showed that in terms of hospital dental care, persons with DD accessed services at a higher rate, both as a population and as individuals.

The high use of hospital-based dental care by the DD population, as compared to the matched comparison group, is consistent with prior research, which suggests that in general, the population with DD uses hospital resources at a higher rate than the general population (Balogh et al., 2005; Morgan et al., 2000). Canadian research on hospital dental care is scarce. One study from the Canadian province of Ontario examined day surgery visits to hospitals for dental problems among the entire Ontario population (i.e., not limited to persons with disability). Using fiscal data from 2003/2004 to 2005/2006, the study found 79,133 day surgery visits were made in Ontario for dental problems (Quinonez, Gibson, Jokovic, & Locker, 2009). Another study conducted in Ontario in 2004 was a retrospective analysis, which examined regional variations in dental procedures among persons with ID. The study found that 40% of day admissions to hospital among people with ID were related to dental care (Balogh et al., 2004). More specially, they found that the most common dental procedures were surgical extraction of tooth, followed by tooth filling and surgical scaling, polishing and debridement.

There are a number of possible explanations for the high use of hospital-based dental services among the DD population in our study. General dentists have limited training in providing dental care to persons with special needs including those with DD (Norwood & Slayton, 2013). In addition, approximately 10-15% of persons with DD have challenging behaviours (Emerson et al., 2001) which makes it difficult for dentists to provide dental care in a regular dental clinic. As a result, the population with DD is found to be at a greater risk for unmet dental care needs. For example, in a survey of families who had children with special needs, 24% reported that their children needed dental care in the past 12 months; about 9% reported that they were not able to obtain the needed dental care (Lewis, 2009). Prior studies have shown that individuals with DD living at home with family or friends have a significantly lower number of

decayed, missing and filled teeth (DMFT) index than those living independently or in care facilities (Lindemann, Zaszchel-Grob, Opp, Lewis, & Lewis, 2001). In Manitoba, a large proportion of the DD population lives in community group homes, where their oral and dental care may not be as high (Leanne Fenez, Director of St. Amant Community Residential Program; personal communication, 2006).

In the present study we examined age distribution of those who experienced hospital-based dental care in our study period. We found that in both study groups, the majority of hospital-based dental care users were children under the age of 20 (66% of the DD group and 95% of the non-DD group). This finding is consistent with the existing literature. Prior studies have shown that pediatric dental surgery is the most common day surgery procedure at pediatric hospitals in Canada (Canadian Paediatric Decision Support Network, 2004). We also found that a much greater proportion of adults in the DD group compared to the adults in the matched comparison group received hospital-based dental care. This finding warrants further research as for underlying factors.

The observed significant difference in urban/rural distribution of hospital-based dental care between the two study groups is an important finding. Our analyses showed that the majority of hospital-based dental care among the non-DD population was for those living in rural and northern regions of Manitoba (63%). This finding could potentially be explained by the relative shortage of dental clinics in rural Manitoba, necessitating the use of hospital-based services. The majority of hospital-based dental care in the DD group was for those under the age of 20 residing in urban health regions in Manitoba (including Winnipeg and Brandon). Given the higher availability of dental services in urban regions compared with the rural and northern regions of Manitoba, lack of access to community-based services is unlikely the reason for the higher use of hospital-based dental services in the urban-dwelling DD population. A contributing factor may be the lack of appropriate training for providing dental care to patients with special needs.

The findings of the present study should be interpreted in the light of several limitations.

First, we used population-based administrative data to identify cases with DD. We acknowledge that although we used several administrative databases, we very likely failed to identify all DD cases living in Manitoba, since some people with DD may never have used the existing health services or social support systems or may not have been diagnosed as having a DD. Second, we used only five years of administrative data to identify DD. A person with DD might not have had that particular diagnosis noted in their medical records within the five years of the study. As a result, we might have missed identifying some Manitobans with DD in this study.

Our study examined the experience of persons with DD, including those classified with intellectual disability and autism spectrum disorders. As the experiences of these latter two populations may differ, further research on these two specific populations would be valuable. Furthermore, as the data in this study is now over 10 years old, more recent data needs to be analyzed to determine if the trends described here have continued.

As the CDA has noted, the role that hospital-based dental programs play in the delivery of oral health care is increasing as demographics and disease patterns have increased the number of people seeking care, including those with concomitant medical problems (CDA, 2013). Indeed, the average life expectancy of persons with DD is increasing and they are expected to use a greater proportion of health care resources in the future (Bittles et al., 2002). However, there is a growing concern that hospital dental services do not have the capacity to meet the demands of the populations they serve. Long wait times for general anesthesia are a major issue for Canadian hospitals. In many provinces, wait times for hospital dental surgery are well in excess of four months (Ontario Ministry of Health and Long-term Care, 2014; Government of Saskatchewan, n.d.). This is especially concerning for Canadians with DD, as requiring general anesthesia for routine dental treatment severely limits the delivery of care to only a few providers at selected facilities. The situation appears to be worse for adults with DD, as children and adolescents with DD can be treated by pediatric dentists in both hospital and private settings,

allowing for another avenue of care. Pediatric dentists receive extensive specialty training in treating patients with special needs, but many limit their scope of practice to patients under 18 years of age. A 2007 study on the treatment of patients with special health care needs in Ontario showed that of 83 pediatric dentists surveyed, 60% limited their practice to only patients 18 years old and under (Loeppky & Sigal, 2006). In addition, hospital dental services are usually limited to major care centers, creating further access and transportation barriers for patients with DD, especially those in rural and remote communities.

The financial implications of providing routine dental treatment in a hospital setting are also important to consider. In the latest report by MCHP on the direct costs of hospitalizations in Manitoba, it reports the average cost of dental extraction or restoration in hospital to be \$1565 per case in Manitoba (MCHP, 2013). This does not include the costs of the physician services associated with the hospital stay or administrative and support services costs. In addition, this represents the cost for a typical case, whereas some cases incur additional costs for management of post-operative complications. Other provinces have also reported similar costs for routine dental procedures performed in hospital (Alberta Health and Wellness, 2006). This demonstrates not only the high costs associated with these services, but also the need for prevention and proper resource allocation.

It is clear that not all routine dental procedures performed in hospital for persons with DD require a hospital setting. A review of the literature suggests that only 5% of the population with disability requires general anesthesia to allow for dental treatment (Girgis, 1985; Milam, 1986). In contrast, of 1,010 individuals at a hospital-based dental program in Ontario for people with disabilities, over 50% received general anesthesia as part of their treatment (Hulland & Sigal, 2000). This same study demonstrated that the main criteria for patient selection in this hospital-based program were behavioral problems, rather than physical or medical conditions. While this may be seen as evidence of inappropriate referrals for dental treatment under general anesthesia on the part of general dentists, there is also evidence that the current undergraduate curriculum in most Canadian

dental schools provides varying and generally limited clinical experience in the treatment and management of special needs patients (Sherman & Anderson, 2010). This is of importance because studies have shown that the more education dentists receive regarding care for patients with special needs, the more likely they are to provide these services to their patients (Dao, Zwetchkenbaum, & Inglehart, 2005).

This study demonstrated that Manitobans with DD use hospital-based dental services at a higher rate than Manitobans without DD. It is still not clear if hospitals are the ideal location for all such patients, or if more efforts should be made to treat these patients in community clinics. Our findings are from the first population-based study with a focus on hospital-based dental care. More research is needed in this area to learn about characteristics associated with hospital-based dental care and to monitor the progress of community-based dental services in providing access to the underserved population with DD.

Key Messages From This Article

People with disabilities: It isn't necessary to go to the hospital every time you get dental care.

Professionals: People with DD are hospitalized for dental care more often than the rest of the population. With specialized training for oral healthcare providers, it may be possible to treat routine problems in community-based clinics.

Policymakers: Individuals with DD use more expensive healthcare services than those without DD, yet have poorer oral health. Expensive hospitalizations for routine dental problems could be avoided with specialized training for oral healthcare providers, and billing policies that encourage treatment in community-based clinics.

Acknowledgments

The authors thank Manitoba Health and the Manitoba Centre for Health Policy, as well as the Department of Education and the Department of Family Services and Labour, for data access and sharing. This research was supported by a research grant from the Canadian Institutes

of Health Research [HIPC no. 2003/2004-30]. We acknowledge the significant contribution of the late Dr. Jeanette J.A Holden, who was instrumental in the development of the study research proposal.

Disclaimer

The results and conclusions are those of the authors, and no official endorsement by the Manitoba Centre for Health Policy, Manitoba Health, or other data providers is intended or should be inferred.

References

- Alberta Health and Wellness. (2006). Health costing in Alberta: 2006 annual report. Edmonton, AB: Health Resourcing Branch, Government of Alberta.
- Allison, P. J., Hennequin, M., & Faulks, D. (2000). Dental care among individuals with Down syndrome in France. *Special Care in Dentistry, 20*, 28-34.
- Allison, P. J., & Lawrence, H. P. (2004). A paired comparison of dental care in Canadians with Down syndrome and their siblings without Down syndrome. *Community Dentistry and Oral Epidemiology, 32*, 99-106.
- Ananthanarayan, C., Sigal, M., & Godlewski, W. (1998). General anaesthesia for the provision of dental treatment to adults with developmental disability. *Anesthesia Progress, 45*, 12-17.
- Balogh, R. S., Hunter, D., & Ouellette-Kuntz, H. (2005). Hospital utilization among persons with an intellectual disability, Ontario, Canada, 1995-2001. *Journal of Applied Research in Intellectual Disabilities, 18*, 181-190.
- Balogh, R. S., Ouellette-Kuntz, H., & Hunter, D. J. (2004). Regional variation in dental procedures among people with an intellectual disability, Ontario, 1995-2001. *Journal of the Canadian Dental Association, 70*, 681, 681a-681f.
- Bittles, A. H., Petterson, B. A., Sullivan, S. G., Hussain, R., Glasson, E. J., & Montgomery, P. D. (2002). The influence of intellectual disability on life expectancy. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 57*, M470-M472.

- Brownell, M., Mayer, T., Martens, P., Kozyrskyj, A., Fergusson, P., & Bodnarchuk, J. (2002). Using a population-based health information system to study child health. *Canadian Journal of Public Health, 93*, S9-S14.
- Burtner, A. P., & Dicks, J. L. (1994). Providing oral health care to individuals with severe disabilities residing in the community: Alternative care delivery systems. *Special Care in Dentistry, 14*, 188-193.
- Canadian Dental Association (CDA). (2013). *CDA position on provincial funding of hospital based dental services and post-graduate dental education*. Retrieved from http://www.cda-adc.ca/_files/position_statements/fundingHospitalDentalServices.pdf
- Canadian Paediatric Decision Support Network Annual Report April 2003-March 2004. (2004). *Report on early childhood caries*. Ottawa, ON: Canadian Paediatric Decision Support Network, Canadian Association of Paediatric Health Centres.
- Casamassimo, P.S., Seale, N.S., & Ruehs, K. (2004). General dentists' perceptions of educational and treatment issues affecting access to care for children with special health care needs. *Journal of Dental Education, 68*, 23-28.
- Dao, L. P., Zwetchkenbaum, S., & Inglehartm, M. R. (2005). General dentists and special needs patients: Does dental education matter? *Journal of Dental Education, 69*, 1107-1115.
- Emerson, E., Kiemann, C., Alborz, A., Reeves, D., Mason, H., Swarbrick, R..., Hatton, C. (2001). The prevalence of challenging behaviors: A total population study. *Research in Developmental Disabilities, 22*, 77-93.
- Fenton, S. J., Hood, H., Holder, M., May, P. B., Jr., & Mouradian, W. E. (2003). The American Academy of Developmental Medicine and Dentistry: Eliminating health disparities for individuals with mental retardation and other developmental disabilities. *Journal of Dental Education, 67*, 1337-1344.
- Ferguson, F. S., Berentsen, B., & Richardson, P. S. (1991). Dentists' willingness to provide care for patients with developmental disabilities. *Special Care in Dentistry, 11*, 234-237.
- Gabre, P., & Gahnberg, L. (1997). Inter-relationship among degree of mental retardation, living arrangements, and dental health in adults with mental retardation. *Special Care in Dentistry, 17*, 7-12.
- Girgis, S. S. (1985). Dental health of persons with severe mentally handicapping conditions. *Special Care in Dentistry, 5*, 246-824.
- Government of Saskatchewan (n.d.). *Saskatchewan Surgical Initiative*. Retrieved from http://www.sk.211.ca/service/13958921_9739721/saskatchewan_surgical_initiative
- Griffin, S., Gooch, B., Beltran, E., Sutherland, J., & Barsley, R. (2000). Dental services, costs, and factors associated with hospitalization for Medicaid-eligible children, Louisiana 1996-97. *Journal of Public Health Dentistry, 60*, 21-27.
- Hennequin, M., Faulks, D., & Roux, D. (2000). Accuracy of estimation of dental treatment need in special care patients. *Journal of Dentistry, 28*, 131-136.
- Hulland, S., & Sigal, M. J. (2000). Hospital-based dental care for persons with disabilities: A study of patient selection criteria. *Special Care in Dentistry, 20*, 131-138.
- Kaye, P. L., Fiske, J., Bower, E. J., Newton, J. T., & Fenlon, M. (2005). Views and experiences of parents and siblings of adults with Down syndrome regarding oral health care: A qualitative and quantitative study. *British Dental Journal, 198*, 571-578.
- Koneru, A., & Sigal, M. J. (2009). Access to dental care for persons with developmental disabilities in Ontario. *Journal of the Canadian Dental Association, 75*, 121.
- Lewis, C. W. (2009). Dental care and children with special care needs: A population-based perspective. *Academic Pediatrics, 9*, 420-426.
- Lindemann, R., Zachel-Grob, D., Opp, S., Lewis, M. A., & Lewis, C. (2001). Oral health status of adults from a California regional center for developmental disabilities. *Special Care in Dentistry, 21*(1), 9-14.
- Loeppky, W. P., & Sigal, M. J. (2006). Patients with special health care needs in general and pediatric dental practices in Ontario. *Journal of the Canadian Dental Association, 72*, 915.

- Manitoba Centre for Health Policy (MCHP). (n.d.). *Direct cost of hospitalizations in Manitoba 2005/06*. Retrieved from http://mchp-appserv.cpe.umanitoba.ca/reference//HospCost_fullreport.pdf
- Manitoba Centre for Health Policy (MCHP). (n.d.). Population Health Research Data Repository, 2009. Retrieved from <http://umanitoba.ca/faculties/medicine/units/mchp/resources/repository/index.html>.
- Martens, P. J., Fransoo, R., The Need To Know Team, Burland, E., Jebamani, L., Burchill, C.,...Bogdanovic, B. (2003). *The Manitoba RHA Indicators Atlas: Population-based comparisons of health and health care use*. Winnipeg, MB:am, S.B.(1986). Pain control in dentistry: General anesthesia. *Compendium of Continuing Education in Dentistry*, 7, 84–87.
- Morgan, C. L., Zahir, A., & Kerr, M. P. (2000). Health care provision for people with a learning disability: record linkage study of epidemiology and factors contributing to hospital care uptake. *British Journal of Psychiatry*, 176, 37–41.
- National Coalition on Dual Diagnosis. (n.d.). *Dual diagnosis glossary*. Retrieved from <http://care-id.com/wp-content/uploads/2011/09/glossary.pdf>
- Norwood K. W., Jr., & Slayton, R. L. (2013). Oral health care for children with developmental disabilities. *Pediatrics*, 131, 614–619.
- Ontario Ministry of Health and Long-term Care. (2014). *Ontario wait times*. Retrieved from <http://www.health.gov.on.ca/en/public/programs/waittimes/>
- Ouellette-Kuntz, H., Shooshtari, S., Temple, B., Brownell, M., Burchill, C., Yu, C.T.,...Hennen, B. (2009). Estimating administrative prevalence of intellectual disabilities in Manitoba. *Journal on Developmental Disabilities*, 15, 69–80.
- Park, M. S., & Sigal, M. J. (2008). The role of hospital-based dentistry in providing treatment for persons with developmental delay. *Journal of Canadian Dental Association*, 74, 353–357.
- Quinonez, C., Gibson, D., Jokovic, A., & Locker, D. (2009). Day surgery visits for dental problems. *Community Dentistry and Oral Epidemiology*, 37, 562–567.
- Robinson, J. R., & Tataryn, D. J. (1997). Reliability of the Manitoba Mental Health Management Information System for Research. *Canadian Journal of Psychiatry*, 42, 744–749.
- Roos, L. L., & Nicol, J. P. (1999). A research registry: Uses, development, and accuracy. *Journal of Clinical Epidemiology*, 52, 39–47.
- Roos, L. L., Jr., Nicol, J. P., & Cageorge, S. M. (1987). Using administrative data for longitudinal research: Comparisons with primary data collection. *Journal of Chronic Diseases*, 40, 41–49.
- Roos, N. P., & Shapiro, E. (1999). Revisiting the Manitoba Center for Health Policy and Evaluation and its population-based health information system. *Medical Care* 37, JS10–JS14.
- Schroth, R.J., & Morey, B. (2007), Providing timely dental treatment for young children under general anaesthesia is a government priority. *Journal of Canadian Dental Association*, 73, 241–243.
- Sherman, C. M., & Anderson, R. D. (2010). Special needs education in Canadian Dental School curriculum: Is there enough? *Journal of the Canadian Dental Association*, 76, A11.
- Statistics Canada. (2014). *Population by year, by province and territory*. Retrieved from <http://www.statcan.gc.ca/tables-tableaux/sum-som/101/cst01/demo02a-eng.htm>
- Tiller, S., Wilson, K. I., & Gallagher, J. E. (2001). Oral health status and dental service use of adults with learning disabilities living in residential institution and in the community. *Community Dental Health Journal*, 18, 167–171.
- Waldman, H. B., Fenton, S. J., Perlman, S. P., & Cinotti, D. A. (2005). Preparing dental graduates to provide care to individuals with special needs. *Journal of Dental Education*, 69, 249–254.
- World Health Organization. International Classification of Diseases. (1977). *Manual of the international statistical classification of disease, injuries, and causes of death* (9th rev.) Geneva, Switzerland: World Health Organization.