Oral Health Status of Long-Term Care Residents—A Vulnerable Population

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Abstract

Objective: To conduct an observational, cross-sectional survey of the oral health status of adults ≥ 45 years of age in rural and urban long-term care (LTC) facilities in Nova Scotia, Canada.

Methods: Residents capable of informed consent were recruited by LTC staff in a stratified random sample of LTC facilities. Calibrated personnel administered standard clinical and quality-of-life instruments.
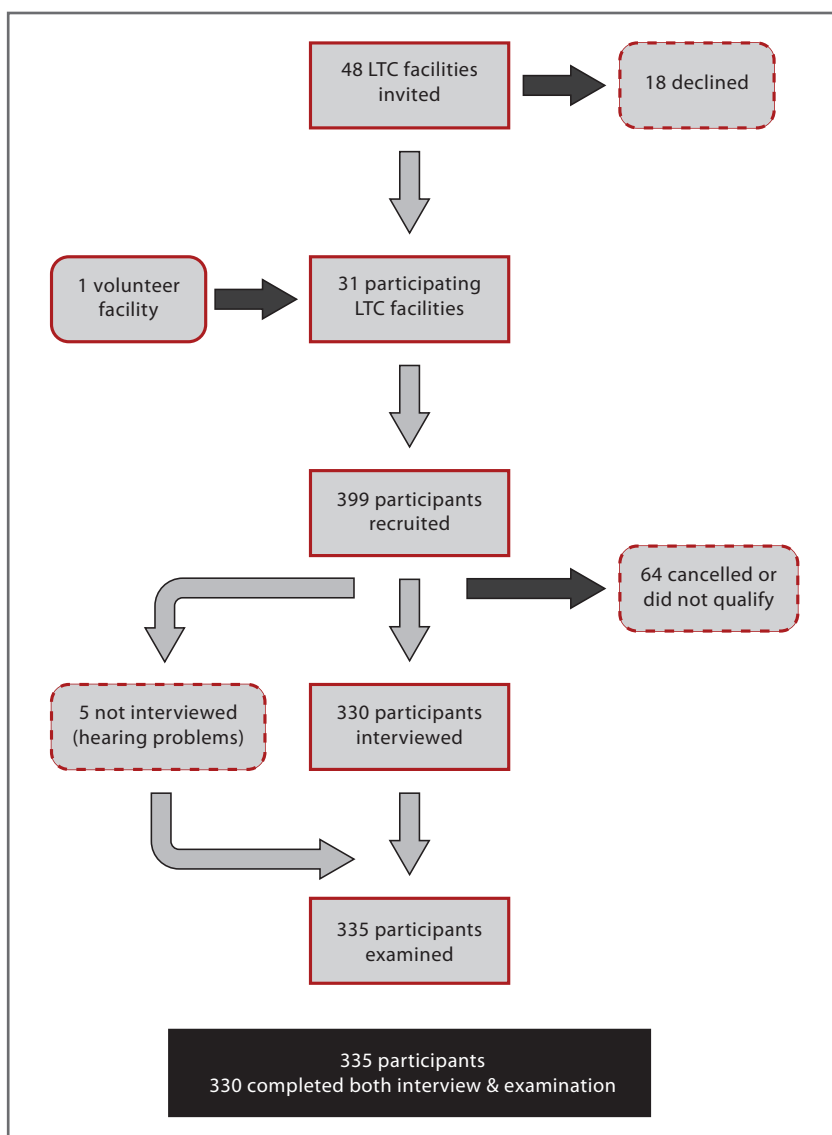
Results: Of the 335 adults (74% female) surveyed (mean age 80.8 ± 11.6 years), only 25% reported having regular dental care. Although 76% described their oral health as good or excellent, 41% were edentulous, 41% had some mucosal abnormality, 36% reported xerostomia and 25% had perceived or self-reported untreated dental conditions. Most mandibular dentures were nonretentive (59%) and almost half were unstable (49%). Among the dentate, 51% had untreated coronal caries, 44% had untreated root caries and 67% had attachment loss of ≥ 4 mm at ≥ 1 site. Predictors of coronal decay were a debris score ≥ 2 (adjusted odds ratio [adj OR] = 2.12; $p = 0.045$) or a history of smoking (adj OR = 1.02 per year of smoking; $p = 0.024$). Predictors of root caries were participants' perceiving a need for dental treatment (adj OR = 2.56; $p = 0.015$) or a history of smoking (adj OR = 1.02 per year of smoking; $p = 0.026$).

Conclusions: This epidemiologic study of the oral health of LTC residents revealed a high prevalence of untreated oral disease and low use of oral care services, highlighting the need for better access to oral care for this population.

Canadians today are living longer[1] and retaining more of their natural teeth[2] than previous generations, emphasizing the need for a greater understanding of oral health over their lifespan. Seniors are a vulnerable population because they have limited access to oral health care; even more vulnerable are those living in long-term care (LTC) facilities.

Research has consistently indicated that the oral health status of residents of LTC facilities is poor; the majority require some form of oral health care intervention.[3]

The percentage of teeth with decayed or filled root surfaces increases with each decade of adulthood, affecting more than one-half of all remaining teeth by age 75 years.[4]

Figure 1: Sampling strategy. LTC = Long-term care.

professional care and the lack of organized dental care for the institutionalized. In Canada, only in-hospital surgical-dental treatment is included in all provincial and territorial health insurance plans, whereas dental treatment is generally limited to programs for children or adults receiving income assistance.[9] The passivity of the health system leaves the question of dental care entirely in the hands of senior citizens who are often limited by physical and organizational barriers (i.e., a lack of standards for oral health care delivery and provision of services) in LTC facilities.[3]

Obtaining clear, relevant data about the oral health status of residents of LTC facilities is an essential first step in planning strategies for the treatment and prevention of oral diseases in this setting. In this paper, we present the outcomes of a provincial survey of the oral health status of residents in LTC facilities in urban and rural Nova Scotia, and examine the predictors of oral disease in this population.

Methods

This study was part of an observational, cross-sectional survey of adults ≥ 45 years of age who were living in the community or in LTC facilities in Nova Scotia, Canada, in 2008–2009. We included in the study only those participants who were capable of giving informed consent. The consent emphasized that the survey was not a substitute for a regular dental examination. We received ethics approval from the Health Sciences Research Ethics Board at Dalhousie University and from District Health Authorities, when required.

Sample Size Determination

In 2006 there were 5827 beds in licensed LTC facilities in Nova Scotia.[10] We used the known population prevalence rates of oral disease from an American survey[11] of 5603 adults ≥ 40 years of age to determine the minimal sample size needed for this study. When we used the prevalence rate of periodontal disease for those ≥ 65 (53%) years

For institutionalized elders especially, an increased risk for caries can be linked to inadequate daily oral hygiene, a high intake of refined carbohydrates and a propensity for xerostomia.[5] The prevalence of xerostomia among institutionalized elders may be as high as 42%[6] and is likely related to taking multiple medications,[7] many of which reduce salivary flow.

Despite the high risk for oral diseases, this population faces greater barriers to receiving dental care than their independent counterparts.[8] Among the reasons for limited access to oral health care are the inability of seniors to afford

of age, a confidence level of 95% and a finite population correction, we calculated that the minimal sample size required to estimate the prevalence with an error rate of 5% was 359 (6% of the population ≥ 65 of age in Nova Scotia).

Sample Selection

We included all private and government-owned LTC facilities in Nova Scotia with ≥ 20 beds per facility in our sampling frame (102 facilities). We chose the minimum bed capacity to facilitate efficient conduct of the survey. We assigned LTC facilities to either rural or urban strata, based on Statistics Canada's rural and small town definition of rural,[12] and designated facilities as small (20–34 beds), medium (35–101 beds) or large (≥ 102 beds), based on capacity. Selecting a proportional sample within the rural and urban strata, we randomly sampled 39 facilities, 23 of which agreed to participate in our study. We recruited 7 additional facilities through a second random selection, and 1 urban facility volunteered (total = 15 rural and 16 urban facilities; **Fig. 1**).

Questionnaire

A single trained interviewer, assisted by a francophone interviewer when required, administered a face-to-face questionnaire that measured the impact of oral health on quality of life, use of oral health care services and access to oral health care. Questions derived from the 2008 Canadian Health Measures Survey[13] included demographics, use of dental care, perceived general health and oral health, regular oral hygiene habits, chronic health conditions, medication use, and history of smoking and alcohol consumption. Additional survey questions determined perceived need for dental care, reasons for not receiving regular dental care and amount paid for dental care. Oral Health-Related Quality of Life was assessed with the OHIP-14[14] (data not reported here). We had the entire questionnaire translated into French and reviewed by an academic fluent in the local dialect.

Clinical Examination

Six calibrated dentists conducted intraoral examinations based on World Health Organization criteria modified for the Oral Health Module of the 2009 Canadian Health Measures Survey.[15] We customized the survey by removing sections on

Table 1: Distribution of LTC participants by facility size and type

Facility	No. (%) of participants (n = 335)
Size of facility	
Small (20–34 beds)	24 (7.4)
Medium (35–101 beds)	219 (65.4)
Large (≥ 102 beds)	92 (27.5)
Type of facility	
Nursing home	296 (88.4)
Assisted living	13 (3.9)
Independent living	26 (7.8)
Location of facility	
Rural	140 (41.8)
Urban	195 (58.2)

LTC = long-term care.

Table 2: Sociodemographic characteristics of LTC participants (n = 335)

Characteristics	No. (%) of participants
Age, in years (n = 330)	
45–64	33 (10.0)
≥ 65	297 (90.0)
Sex (n = 330)	
Male	84 (25.5)
Female	246 (74.5)
Education level (n = 329)	
≥ High school	76 (23.1)
< High school	253 (76.9)
Dental insurance (n = 306)	
Yes	53 (17.3)
No	253 (82.7)
Annual household income (n = 259)	
> $20 000	50 (19.3)
≤ $20 000	209 (80.7)

fluorosis and orthodontic skeletal classifications, and adding an examination of jaw function and quality of prosthetics. The dentists examined participants in a portable A-dec chair (A-dec Inc., Newberg, OR) and an Aseptico light (Aseptico Inc., Woodinvile, WA) or in their wheelchair or

Table 3: Dental history of LTC participants (n = 335)

Dental history	No. (%) of participants	Mean ± SD
Toothbrushing (*n* = 318)		
Brushing frequency (per day)		1.75 ± 1.00
Brush < twice per day	155 (48.7)	
Flossing (dentate only; *n* = 190)		
Floss < once per day	190 (83.2)	
Regular dental care provider[a] (*n* = 325)		
Dentist	93 (28.6)	
Dental hygienist	34 (10.5)	
Denturist	21 (6.5)	
Physician	5 (1.5)	
Other	6 (1.8)	
None	210 (64.6)	
Dental visit frequency (*n* = 324)		
Visit < once per year	244 (75.3)	
Last dental visit (*n* = 313)		
Within last year	84 (26.8)	
1–3 years ago	67 (21.4)	
> 3–5 years ago	31 (9.9)	
> 5 years ago	131 (41.9)	

SD = standard deviation.
[a] Participants could choose more than 1 option.

bedside using a headlamp. The dentists took no radiographs.

The examining dentists recorded the degree of edentulism and reasons for loss of any teeth, excluding third molars, coronal and root caries, and type of restorative material in filled teeth. They determined periodontal and gingival status using the gingival index, debris index-simplified, calculus index-simplified, pocket-probing depth and clinical attachment levels. They assessed jaw function[16] and recorded the stability, retention, hygiene and structural integrity of removable dentures.[17]

The dentists noted individual immediate and emergency treatment needs. Reasons for immediate treatment were asymptomatic untreated decay or periodontal disease, fractured teeth or dentures needing repair or replacement, and those for emergency treatment were pain, risk of cellulitis or suspected malignancy. In all cases, the dentists copied their recommendations to continue regular care, seek care at earliest convenience or seek care immediately to the care facility administrator. They did not recommend specific treatment.

Data Management and Analysis

A single research assistant entered all clinical data directly into a password-protected database. Two research assistants recorded data from interviews on paper and entered the data into the database. We ensured data quality with periodic quality control checks and interventions. We reviewed the clinical database weekly for missing or inconsistent data and reported any issues to the research assistant to anticipate and avoid future errors. For the interview data, each research assistant checked the other's data entry against the original hardcopy and corrected any errors.

We calculated logistic regression using PASW Statistics 17 (IBM SPSS Inc., Chicago, IL) to analyze predictors of denture use, coronal caries and root caries, and Poisson regression using

Stata 9 (StataCorp LP, College Station, TX) to analyze predictors of the decayed, missing, filled teeth (DMFT) index. We used 2-tailed statistical tests and considered a *p* value ≤ 0.05 as significant.

Results

We conducted surveys in 31 LTC facilities in 21 communities from October to November 2008 and April to October 2009. Forty-two percent of participants resided in rural LTC facilities and 58% in urban facilities (**Table 1**), which is proportionate to the distribution of the general population in Nova Scotia. We recruited a total of 399 participants, out of which, 64 (16%) cancelled or did not qualify, and 330 (83%) completed both the interview and oral examination (5 in French, 225 in English); 5 (1%) people with hearing problems completed the clinical examination, but not the interview (**Fig. 1**). The survey sample was 93% (335/359) of the target sample.

Questionnaire

The average age of the participants was 80.8 ± 11.6 years (range 45.0–104.0 years; **Table 2**). More women than men participated in the survey, which reflects the gender imbalance in the Nova Scotia senior population.[18]

The median reported income range was CAD $10 000 to $20 000, lower than that of seniors living independently in the community. In 2006, the average income for households headed by someone between the ages of 65 and 74 years in Nova Scotia was CAD $44 371, and the income for households headed by someone ≥ 75 years of age was $36 858.[1] Few (17%) participants had third-party insurance for dental care (**Table 2**).

More than half (52.8%) of participants were current (*n* = 29) or former (*n* = 148) smokers. The average number of years participants smoked was 34.2 ± 21.5 (range = 1–76).

Most (75%) participants reported visiting a dental professional less than once per year and 42% reported their last visit to a dental professional was > 5 years ago (**Table 3**). Many (85%) reported having a chronic health condition and 98% were taking at least one type of medication. Despite this, two-thirds perceived their general health as good to excellent (**Table 4**). Similarly, although 53% reported dental or oral problems

Table 4: Self-rated general and oral health perceptions of LTC participants (*n* = 335)

Participants' perception	No. (%) of participants
Self-rated health (*n* = 329)	
Excellent/very good/good	217 (66.0)
Fair/poor	112 (34.0)
Self-rated oral health (*n* = 324)	
Excellent/very good/good	245 (75.6)
Fair/poor	79 (24.4)
Perceived need for dental treatment (*n* = 331)	82 (24.8)
Self-reported dental/oral problems (*n* = 324)	
Toothache	17 (5.2)
Sensitivity to hot or cold	27 (8.3)
Severe tooth/mouth pain at night	4 (1.2)
Pain in/around jaw joints	26 (8.0)
Bleeding gums from toothbrushing	26 (8.0)
Persistent dry mouth (xerostomia)	121 (37.3)
Persistent bad breath	22 (6.8)
Total participants with ≥ 1 problem	170 (52.5)

Table 5: Mucosal status of LTC participants

Mucosal status[a]	No. (%) of participants (*n* = 335)
Angular cheilitis	11 (3.3)
Mucosal white patches	14 (4.2)
Denture stomatitis	41 (12.2)
Denture-induced hyperplasia	1 (0.3)
Glossitis	24 (7.2)
Sinus or fistula	1 (0.3)
Aphthous ulcer	1 (0.3)
Ulcer (traumatic or other)	20 (6.0)
Extreme alveolar atrophy	47 (14.0)
Ridge fibrosis	11 (3.3)
Total participants with an abnormality	138 (41.2)

[a]Participants may have reported more than one problem.

(xerostomia being the most common), only 25% thought they had untreated dental needs and about three-quarters perceived their oral health as good to excellent (**Table 4**).

Table 6: Dentate status and decayed, missing and filled teeth of LTC participants (*n* = 335)

Condition of teeth	No. (%) of participants	Mean no. of teeth ± SD (range)
Dentate status		
Dentate — both arches	117 (34.9)	
Dentate — upper arch	6 (1.8)	
Dentate — lower arch	75 (22.4)	
Edentulous	137 (40.9)	
DMFT		
Decayed teeth		0.81 ± 1.83 (0–15)
Filled teeth		3.09 ± 4.89 (0–23)
Missing teeth		19.66 ± 9.03 (0–28)
Total DMFT		23.56 ± 5.27 (6–28)

DMFT = Decayed, missing and filled teeth, SD = standard deviation.

Table 7: Prosthetic status and denture quality for LTC participants (*n* = 335)

Status or quality of prosthetics	No. (%) of participants with maxillary prosthetics	No. (%) of participants with mandibular prosthetics
Prosthetic status (*n* = 335)		
None	100 (29.9)	212 (63.3)
Fixed bridge	9 (2.7)	8 (2.4)
Implant	1 (0.3)	0 (0.0)
Partial denture acrylic	14 (4.2)	10 (3.0)
Partial denture cast chrome	22 (6.6)	19 (5.7)
Full denture	192 (57.3)	88 (26.3)
Quality of denture[a]		
Unstable	68 (29.8)	57 (48.7)
Nonretentive	47 (20.6)	68 (58.1)
Need repair	23 (10.1)	10 (8.5)
Poor hygiene (> 50% surface with plaque)	38 (16.7)	15 (12.8)

[a]*Percentages refer to the proportion of participants with either a maxillary (*n* = 228) or mandibular complete or partial denture (*n* = 117).*

Clinical Examination

The average time to complete the oral examination was 12.3 ± 6.7 minutes (range 2.4–43.7 minutes, *n* = 335). Mucosal abnormalities were present in 41.2% of participants (**Table 5**). The most prevalent were related to edentulism: extreme alveolar ridge atrophy (14.0%) and denture stomatitis (12.2%). Glossitis was present in 7.2% and traumatic ulcers in 6.0% of the participants. The examining dentists found no lesions that suggested a possible malignancy during the survey.

Only 1 participant had significant occlusal wear, whereas 33.1% (*n* = 111) had inadequate occlusal contacts (i.e., occlusal contact between > 2 posterior teeth bilaterally). No participants had limited mandibular opening.

Forty-one percent of participants were edentulous (**Table 6**). More had maxillary full or partial dentures (68%) than mandibular dentures (35%). Of those completely edentulous, 92.6% wore their upper dentures all of the time (including those who took their denture out at night). More than

Table 8: Prevalence of coronal and root caries among dentate participants

Caries or restorations	No. (%) of participants (*n* = 198)	Mean no. of teeth ± SD (range) per participant
Coronal caries		
DT		1.37 ± 2.21 (0–15)
≥ 1 DT	101 (51.0)	
FT		5.22 ± 5.42 (0–23)
DFT		6.60 ± 5.47 (0–24)
≥ 1 DFT	179 (90.4)	
Root caries		
DR		1.44 ± 2.56 (0–16)
≥ 1 DR	88 (44.4)	
FR		1.12 ± 2.08 (0–12)
DFR		2.56 ± 3.09 (0–16)
≥ 1 DFR	127 (64.1)	
Tooth surfaces with amalgam restorations (coronal and root)		7.48 ± 9.36 (0–49)

DFR = decayed or filled roots, DFT = decayed or filled teeth, DR = decayed roots, DT = decayed teeth, FR = filled roots, FT = filled teeth, SD = standard deviation.

Table 9: Periodontal status of LTC dentate participants (dentate only; *n* = 198)

Indicator of periodontal status	No. (%) of participants	Mean ± SD (range)
GI		1.52 ± 0.78 (0–3)
GI ≥ 2 at ≥ 1 sites (*n* = 186)	122 (65.6)	
Debris index (*n* = 194)		1.40 ± 0.65 (0–3)
Calculus index (*n* = 194)		1.12 ± 0.82 (0–3)
PD (mm) PD ≥ 4 mm at ≥ 1 sites (*n* = 174)	63 (36.2)	2.49 ± 1.27 (0–9)
AL (mm) AL ≥ 4 mm at ≥ 1 sites (*n* = 174)	116 (66.7)	3.92 ± 1.87 (0–12)

AL = attachment loss, GI = gingival index, PD = probing depth, SD = standard deviation.

a third (36.0%) did not have or never wore their lower denture. Mandibular dentures, when worn, were more likely to be unstable than maxillary dentures (**Table 7**).

Among the dentate or partially dentate, there was a high caries rate (**Table 8**), on both coronal and root surfaces. The proportion with untreated root caries was similar to that with untreated coronal caries (44.4% versus 51.0%). Nearly two-thirds exhibited untreated or restored root caries on ≥ 1 teeth.

Two-thirds of participants had attachment loss of ≥ 4 mm, that is gingival recession, as reflected in the prevalence of root caries. About one-third of participants had ≥ 1 periodontal pockets of ≥ 4 mm depth (**Table 9**).

Table 10: Regression models

Response variable (no. of participants)	Predictor variables	Adjusted odds ratio	95% CI	*p* value[a]
≥ 1 decayed or filled roots (dentate only; *n* = 164)	Perceiving need for oral treatment	2.56	1.20–5.46	0.015
	Years of smoking	1.02	1.00–1.04	0.026
≥ 1 decayed crowns (dentate only; *n* = 129)	Debris score ≥ 2	2.12	1.02–4.34	0.045
	Years of smoking	1.02	1.00–1.04	0.024
Use of both upper and lower dentures all of the time (edentulous only; *n* = 90)	45–74 years of age	1.00	–	–
	75–84 years of age	5.26	1.32–20.00	0.018
	≥ 85 years of age	3.57	1.02–12.50	0.047
	Living in an urban area	3.85	1.28–11.11	0.017
	No impacts fairly/very often on the OHIP-14	4.76	1.59–14.29	0.005
Response variable	**Predictor variables**	**Prevalence ratio**	**95% CI**	***p* value[b]**
DMFT (dentate only; *n* = 166)	Brush < 1 per day	1.183	1.055–1.327	0.004
	Years of smoking	1.002	1.001–1.004	0.017
	≥ 65 years of age (vs 45–64)	1.258	1.127–1.405	< 0.001

CI = confidence interval, DMFT = decayed, missing and filled teeth.
[a] Obtained from logistic regression with the stepwise selection and removal method based on the significance of the score statistic.
[b] Obtained from Poisson regression with the stepwise selection and removal method based on the significance of the z statistic.

Predictors of Oral Disease

The most significant predictor of coronal decay was a high debris score, whereas perceiving a need for dental care was the most significant predictor of root caries (**Table 9**). Number of years of smoking (both current and former smokers) was a predictor for both root and coronal caries. Predictors of an increased DMFT score were increased age, years of smoking and brushing less than once a day (**Table 10**).

For the edentulous, the use of dentures (both upper and lower) all the time (except at night) was chosen as an indicator of oral health. Increased age, living in an urban area and infrequent impacts of oral conditions on oral health reported on the OHIP-14 (i.e., the prevalence of people reporting ≥ 1 item fairly often or very often, indicating a higher impact on oral health-related quality of life) were all predictors of regular denture use (**Table 10**).

Discussion

Challenges of Surveying in LTC

The main challenges of working in LTC settings were related to recruitment and space limita-tions. Recruitment of an adequate sample size was difficult because of the requirement that par-ticipants be able to provide informed consent and cancellations because of fatigue or illness. We dealt with this problem by overbooking appointments and extending the number of sampling days. Many facilities had limited space to accommodate the survey. The survey team used their portable dental chair and light in boardrooms, offices, activity rooms and hair dressing salons. The latter location worked well because there was a sink where the clinician could wash, and the chairs were adapt-able for the clinical examination.

Implications of Results

The disease prevalence rates for this popula-tion of LTC residents fell within the ranges reported by other studies of institutionalized older people in industrialized countries. For example, 41% of participants in our study were edentulous com-pared with rates of 25%–64% in other studies[5,19-22]; 51% of our dentate participants had untreated coronal caries compared with 50%–68% reported in other studies[5,21-22]; and 44% of our participants had untreated root decay compared with reported

rates of 46%–88% in other studies.[5,22] Mean DMFT in this study (23.6) also fell within the range of 22.8–26.6 reported in other studies.[5,22]

Given the frailty of the population examined in our study, it is not surprising that a high proportion of the older participants experienced oral health problems. Self-care impairment is endemic in the nursing home population because of impaired visual acuity and decreased manual dexterity. LTC residents often rely on personal care-workers, who may be overloaded with daily work and may have little training in oral disease management[23,24] for daily oral care. Further, personal care workers often view mouth care as more disagreeable than other nursing activities.[23,24] Often LTC facilities do not enforce oral care policies.[25] In addition few LTC facilities in Nova Scotia have access to professional oral care,[26] which is reflected in the fact that two-thirds of the participants in our study had no regular dental care. Even if LTC residents are able to visit a dental care provider in the community, few have the financial means to do so.[26] Recent changes to provincial legislation that allow dental hygienists to be self-regulated may alleviate some of the oral care burden. However in Nova Scotia, hygienists can provide limited restorative therapy only under the supervision of a dentist. Because caries is prevalent in this population, much of the oral disease will remain untreated.

Recent policy recommendations for improving the oral health of LTC residents encompass a wide range of workforce and system strategies. These include reforming the oral health care reimbursement system,[3] educating oral health professionals to deal with the needs of frail and dependent older adults, developing standards for daily oral hygiene for LTC residents,[3,27] educating institutional staff and using existing oral health professionals in new ways.[27]

Study Limitations

A lack of readily accessible data about the sociodemographic characteristics of LTC residents in Nova Scotia makes comparisons to the target population difficult. Because many residents were ineligible for our study because they were unable to give informed consent, we did not expect the sample from this survey to be representative of all LTC residents in Nova Scotia. Indeed, it is likely that the residents not represented (because of poor health or inability to give informed consent) have worse oral health status than those sampled because a loss of cognitive and functional capacity is predictive of need for oral treatment in LTC residents.[28] Thus, the disease prevalence rates revealed in this study are likely conservative estimates of the true prevalence.

The use of an on-site recruiter (director of care or nursing, recreation coordinator or administrator) introduced the possibility of selection bias. This bias could go in either of 2 directions, namely, selecting residents believed to have the greatest oral health needs or selecting residents who were cooperative or physically active. We suspect the latter because recruiters frequently reported being challenged to find enough residents who were both physically able and capable of giving informed consent. Again, this bias would underestimate the true prevalence of oral disease.

Conclusions

A small but increasing fraction of the older adult population lives in residential continuing care settings, yet this population is most in need of oral care because of their limited mobility, multiple health issues and general loss of autonomy. The data from our study show what problems exist and to what extent they are present in this population—data essential to the improvement of health services. ❧

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