






## ORIGINAL ARTICLE

# Integration of a dental hygienist into the interprofessional long-term care team

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**Background:** To address poor oral health of residents in long-term care homes (LTCH), this study explored the process of integrating an educational resource and a dental hygienist on the interprofessional care team.

**Methods:** This convergent mixed-methods study took place at a 472-bed LTCH in Toronto, Canada from February to August 2018. Nurses employed at the LTCH participated in the study. During the study period, a dental hygienist was integrated into an interprofessional LTCH team. Nurses completed an online eLearning module about using the Oral Health Assessment Tool (OHAT) when referring residents' oral health concerns to a. Pre/post knowledge quizzes, module feedback and satisfaction surveys were administered. A retrospective chart review examined OHAT use and compared nurse and dental hygienist oral health assessments. Two cycles of semi-structured interviews with five nurses explored experiences with the eLearning module, OHAT and integration of the dental hygienist into the team.

**Results:** Nurses scored well on the knowledge quizzes and reported comfort in using the OHAT to refer oral concerns to a dental hygienist; however, actual use was minimal. oral health issues were under-reported by nurses on the Resident Assessment Instrument-Minimum Data Set (RAI-MDS); the dental hygienist reported significantly more debris, teeth lost and carious teeth (all  $P < 0.0001$ ). Qualitative analysis indicated that the nurses valued dental hygienist integration into the team. Using knowledge mobilisation practices, a new oral health referral tool was developed.

**Conclusions:** This study highlights the feasibility and desirability of an oral health eLearning module, practical assessment tools and participation of a dental hygienist on the LTCH interprofessional care team.

## KEYWORDS

dental hygienist, eLearning module, interprofessional care, long-term care, nurse education, oral assessments, oral health

## 1 | INTRODUCTION

Maintaining proper oral health is critical for older adults living in long-term care homes (LTCH). Oral health problems are linked to poor overall health and psychological well-being, malnutrition and mortality.<sup>1,2</sup> Several chronic conditions, such as type II diabetes, are associated with untreated periodontal disease.<sup>3</sup> Further, oral pathogens, including those associated with periodontal disease, and the presence of dental plaque increase the risk of developing aspiration pneumonia.<sup>4</sup> Many LTCH residents have some form of cognitive impairment such as dementia, limiting their ability to receive proper oral care and rendering them more susceptible to periodontal disease.<sup>5</sup> Oral health can be a determinant of well-being in later life.<sup>6</sup>

Despite these known associations between oral health and wellness, LTCH residents face great challenges in accessing oral healthcare,<sup>7</sup> leading to increased rates of poor oral health among older adults in LTCH. Oral diseases have a high global average prevalence of 45%, and the burden of oral diseases is unequally distributed across vulnerable populations—older adults living in LTCH are among those most affected.<sup>8</sup> An oral hygiene assessment of 506 residents from 14 LTCH homes (LTCHs) in Finland found that, on average, plaque covered more than one-third of the tooth surface or half of denture surfaces, and that mild gingival irritation was often present.<sup>9</sup> Similarly, a national study of 32 LTCHs across four Canadian provinces showed that 79.6% of residents were diagnosed with moderate-to-severe gingival inflammation.<sup>10</sup> Most residents in this study had moderate or severe inflammation on at least one tooth (79.6%), and 86% of the residents required urgent dental treatment for oral health problems such as broken teeth, infection, severe decay and ulcers.

There is growing awareness of this issue. In 2022, the World Health Organization recommended shifting attention from addressing outcomes of dental disease towards preventive models.<sup>8</sup> However, there is a continued need to identify innovative strategies that allow LTCH staff to deliver preventive interventions to residents. The oral health of residents is often poor as some residents are unable to complete basic activities of daily living themselves or have limited access to dental professionals.<sup>2,11,12</sup> It is recommended that LTCH teams consult with dental professionals when oral health concerns arise. Further, collaboration between nursing staff and dental professionals is warranted within LTCH to optimise oral care delivery to residents.<sup>13</sup> Interprofessional collaboration further bridges the gap between LTCH residents and their access to preventive oral healthcare, possibly providing a viable solution for the growing oral healthcare needs across the sector.

Recently, the Canadian Dental Hygienists Association developed recommendations on oral care for LTCH residents. Their first recommendation was to incorporate dental hygienists into LTCH teams.<sup>14</sup> dental hygienists have the skills and knowledge to examine patients for signs of oral diseases, such as gingivitis, to provide preventive oral hygiene care, and to identify residents who require a referral to a dentist.<sup>14,15</sup> Dental hygienists can formulate treatment plans that are targeted to the specific needs of LTCH

residents.<sup>16</sup> In one study of five Australian LTCHs, the utilisation of a dental hygienist improved the oral health of residents (denoted by plaque reduction) via appropriate and timely dental care referrals for at-risk residents.<sup>17</sup> The findings of another study showed that oral health management by dental hygienists was associated with a lower incidence of pneumonia among LTCH residents, thereby emphasising the importance of integrating dental professionals in LTCH care teams.<sup>18</sup>

The purpose of this project was to optimise the oral health of older adults living in LTCH by mobilising knowledge of preventative dental practices. The present study sought to evaluate the outcomes associated with integrating a dental hygienist into an interprofessional LTCH team and bridging the education and resource needs among nurses working in the LTCH.

## 2 | METHODS

### 2.1 | Study design and sample

This study adopted a convergent mixed-methods design<sup>19</sup> and was part of a larger quality improvement (QI) initiative (Figure 1), which took place at a 472-bed LTCH facility in Toronto, Ontario, Canada. Research ethics approval was obtained from the Baycrest Research Ethics Board (#17-50). This QI project was conducted between February 2018 and August 2018. Three interventions were implemented and evaluated to explore their impact on nurses' knowledge and application of oral health practices and referrals for older adults in LTCH. Interventions were chosen based on consultations between an experienced dental hygienist and leadership at the LTCH, who were interested in adopting best-practice strategies to promote the oral health of residents in LTCH. Knowledge mobilization (KM) strategies were used to encourage the adoption of the new assessment and referral pathway.<sup>20,21</sup>

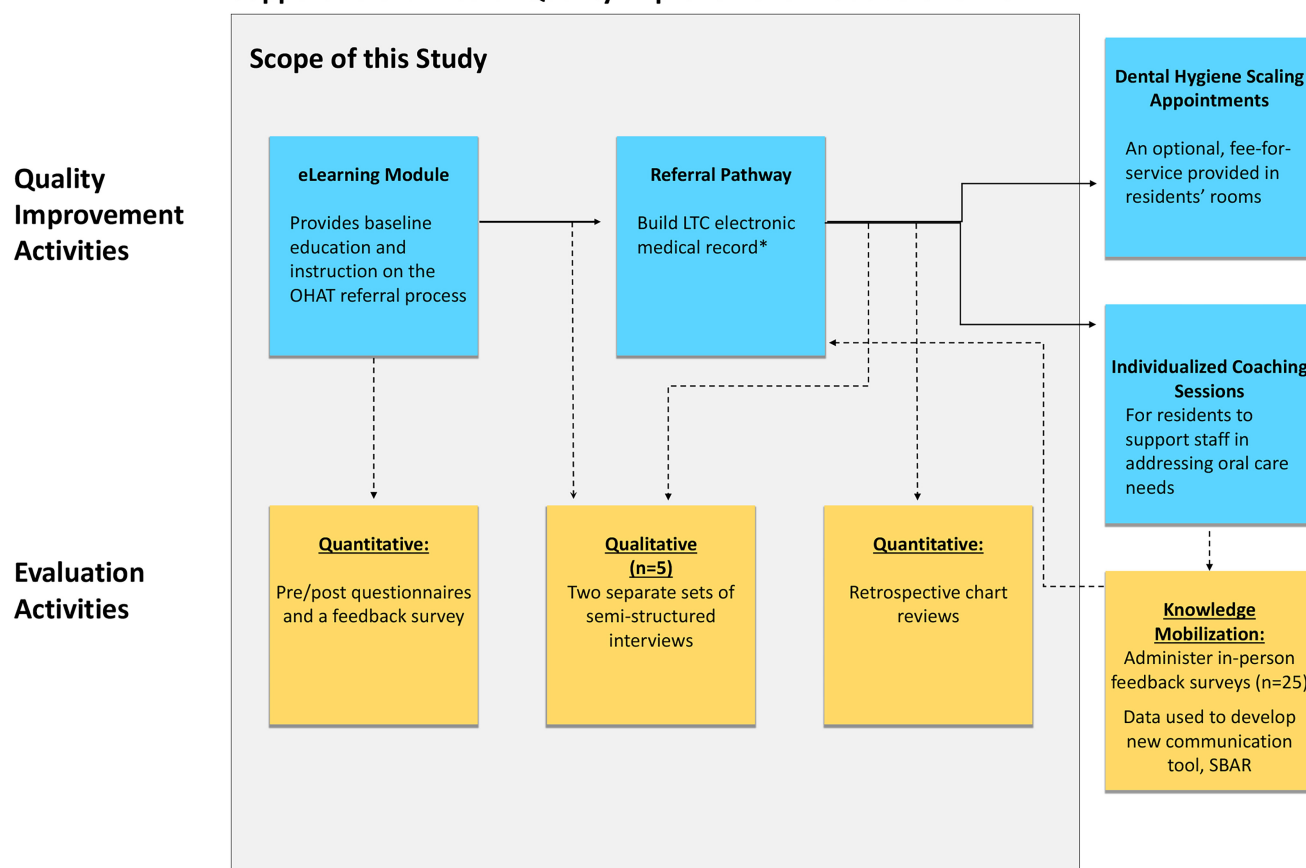
All 83 registered practical nurses (RPNs) and 20 registered nurses (RNs) on staff at the LTCH during the study period (collectively referred to as "nurses" throughout this work) were invited to participate in the study. A total of 67 nurses completed at least one survey or quiz (65% response rate). QI activities involving personal support workers (PSWs) as well as implementation of this QI initiative at other LTCHs have been reported elsewhere (see Pawluk et al.<sup>22</sup>).

### 2.2 | Evaluated interventions

#### 2.2.1 | Intervention 1 – RAI-MDS oral health assessments

Ontario Ministry of Long-Term Care policies state that each LTCH resident must have a full Resident Assessment Instrument–Minimum Data Set (RAI-MDS) assessment completed annually.<sup>23</sup> The RAI-MDS is an assessment tool built into the LTCH electronic

## Supportive Oral Health Quality Improvement Initiative Overview



\*Knowledge Mobilization strategies resulted in a switch from using the Oral Health Assessment Tool (OHAT) to the Situation, Background, Action, Response (SBAR) tool that nurses can use to call the dental hygienist

FIGURE 1 Overview of quality improvement initiative.

medical record (EMR) (Meditech, Westwood, MA, USA) that provides a standardized, interdisciplinary approach to care planning in LTCH.<sup>24</sup> It is routine clinical practice that each resident has a full RAI-MDS assessment (including one oral health assessment item from section K and seven items from section L) upon admission to an LTCH facility (the reference date) and annually thereafter (updated reference date; Figure 2).

A convenience sample of residents who were scheduled for a full RAI-MDS assessment by nursing staff during the study period had the oral health section of the RAI-MDS independently reassessed by the dental hygienist (n=65). Nurses selected the residents based on their scheduled updated reference date. The assessments were completed within 7 days after the updated reference date.

Resident RAI-MDS assessments were conducted by several trained clinical nurse assessors. Nurses conducting these assessments are often different from staff who provide daily oral care. The oral assessment consisted of a visual inspection during regular oral care. At the time of assessment, nurses obtained permission from residents to examine their mouths. All RAI-MDS scores are entered into residents' EMR; the oral health component of the

RAI-MDS is part of sections K and L. Section K features one item: 'Resident is experiencing mouth pain'. Section L consists of seven 'yes/no' items, including: (1) 'debris present in mouth prior to going to bed at night'; (2) 'the resident has dentures and/or removable bridge'; (3) 'some or all natural teeth lost—does not have or does not use dentures (or partial plates)'; (4) 'broken, loose or carious teeth'; (5) 'inflamed gums (gingiva); swollen or bleeding gums; oral abscesses; ulcers or rashes are present'; (6) 'daily cleaning of teeth or dentures, or daily oral care by bedtime—by resident or staff' and (7) 'none of the above'. If the resident presented with any of these conditions within 7 days of the reference date, nurses provided a 'yes' response. Any concerns from the RAI-MDS oral assessments were noted in the EMR, and a review of the resident's clinical record was completed by the nurse. If oral concerns were identified during the assessment, the nurse completing the RAI-MDS consulted with the resident's direct care staff (e.g. PSW or nurses) for follow-up.

During the study period, a dental hygienist completed separate RAI-MDS oral health assessments for QI purposes. These assessments were conducted with the same set of residents who underwent a full RAI-MDS with a nurse assessor. The dental

Enter/Edit L: Oral/Dental Status (Page 1) X

L1. Oral Status and Disease Prevention

A. Debris (Soft, Easily Removable Substances)  
Present in Mouth Prior to Going to Bed at Night

N

B. Has Dentures and/or Removable Bridge

N

C. Some/All Natural Teeth Lost - Does Not Have or  
Does Not Use Dentures (Or Partial Plates)

N

D. Broken, Loose, or Carious Teeth

N

E. Inflamed Gums(Gingiva): Swollen or Bleeding  
Gums; Oral Abscesses; Ulcers or Rashes

N

F. Daily Cleaning of Teeth/Dentures or Daily  
Mouth Care - by Resident or Staff

N

G. None of the Above

FIGURE 2 Section L1 (oral health component) of the RAI-MDS assessment.<sup>24</sup>

hygienist completed the oral health sections of the RAI-MDS and assessed mouth pain within 7 days of the updated reference date. De-identified assessment data were entered into Qualtrics (Qualtrics XM, Seattle, WA, USA) for evaluation purposes. Assessments were not completed by either the nurse or dental hygienist if the resident refused, was ill or unavailable or had been discharged.

### 2.2.2 | Intervention 2—Oral health education

At the LTCH, the Department of Dentistry collaborated with the Centre for Education and Knowledge Exchange in Aging to create a 15-min online eLearning module on evidence-based oral health practices, which was mandatory for all nurses to complete via the Surge Learning System.<sup>25</sup> The self-guided eLearning module also included instructions on how to score the Oral Health Assessment Tool (OHAT; Figure 3).<sup>26</sup> The OHAT is a validated tool intended for use among older adults who are unable to reliably self-report oral health concerns and who require a clinical assessment. It consists of a visual inspection of eight categories.<sup>27</sup> The eight categories of the OHAT assess lips, tongue, gums and tissues, saliva, natural teeth, dentures, oral cleanliness and dental pain. Each of the eight categories is scored as 0 = 'healthy', 1 = 'changes' or 2 = 'unhealthy'. If a score of 1 or 2 is given to any category, it prompts the assessor (nurse) to refer the resident to a dental professional. While completing the

eLearning module, nurses were taught how to use the OHAT to refer resident oral health concerns to a dental hygienist for oral health assessments and further care.<sup>27</sup> Evaluation of the eLearning was completed by (1) asking the nurses to complete knowledge quizzes before and after finishing the module, (2) soliciting feedback through a knowledge and satisfaction survey upon module completion and (3) inviting nurses to participate in an interview to describe their experiences with the eLearning module.

### 2.2.3 | Intervention 3—Integrating dental hygienist knowledge into the interprofessional LTCH team

The overall aim of the QI was to evaluate the support needed to integrate a dental hygienist into the LTCH primary care team. The OHAT was integrated into the EMR after all staff had completed the eLearning module and received training on the assessment tool. This way nurses could refer residents using the OHAT assessment for dental hygienist consultations and/or dental hygiene services on an as-needed basis. Nurses received instructions on how to use and score the OHAT through the eLearning module and were invited to attend dental hygienist-led information sessions. LTCH management also encouraged the use of the newly integrated OHAT in the EMR for dental hygienist referrals. OHAT uptake and referrals were routinely monitored through a review of the residents' EMR.

Resident: _____			Date: ____/____/____	
Completed by: _____				
Scores – You can circle individual words as well as giving a score in each category (* if 1 or 2 scored for any category please organize for a dentist to examine the resident)				
Category	0 = healthy	1 = changes*	2 = unhealthy*	Category scores
<b>Lips</b>	smooth, pink, moist	dry, chapped, or red at corners	swelling or lump, white/red/ ulcerated patch; bleeding/ ulcerated at corners	
<b>Tongue</b>	normal, moist, roughness, pink	patchy, fissured, red, coated	patch that is red and/or white, ulcerated, swollen	
<b>Gums and tissues</b>	pink, moist, smooth, no bleeding	dry, shiny, rough, red, swollen, one ulcer/sore spot under dentures	swollen, bleeding, ulcers, white/red patches, generalized redness under dentures	
<b>Saliva</b>	moist tissues, watery and free flowing saliva	dry, sticky tissues, little saliva present; resident thinks they have a dry mouth	tissues parched and red, very little/no saliva present, saliva is thick, resident thinks they have a dry mouth	
<b>Natural teeth Yes/No</b>	no decayed or broken teeth/roots	1-3 decayed or broken teeth/ roots or very worn down teeth	4 + decayed or broken teeth/ roots, or very worn down teeth, or less than 4 teeth	
<b>Dentures Yes/No</b>	no broken areas or teeth, dentures regularly worn, and named	1 broken area/tooth or dentures only worn for 1-2 hrs daily, or dentures not named, or loose	more than 1 broken area/ tooth, denture missing or not worn, loose and needs denture adhesive, or not named	
<b>Oral cleanliness</b>	clean and no food particles or tartar in mouth or dentures	food particles/tartar/plaque in 1-2 areas of the mouth or on small area of dentures or halitosis (bad breath)	food particles/tartar/plaque in most areas of the mouth or on most of dentures or severe halitosis (bad breath)	
<b>Dental pain</b>	no behavioural, verbal, or physical signs of dental pain	verbal and/or behavioural signs of pain such as pulling at face, chewing lips, not eating, aggression	physical pain signs (swelling of cheek or gum, broken teeth, ulcers), as well as verbal and/ or behavioural signs (pulling at face, not eating, aggression)	
<input type="checkbox"/> Organize for resident to have a dental examination by a dentist <input type="checkbox"/> Resident and/or family/guardian refuses dental treatment <input type="checkbox"/> Complete Oral Hygiene Care Plan and start oral hygiene care interventions for resident <input type="checkbox"/> Review this resident's oral health again on Date: ____/____/____				<b>TOTAL SCORE:</b> <u>16</u>

FIGURE 3 Oral health assessment tool.<sup>26,27</sup>

### 2.3 | Qualitative data collection

Two cycles of audio-recorded, semi-structured one-on-one interviews were held during the study period. An independent researcher (KJ) conducted these interviews. Upon completion of the eLearning module, nurses from all units were invited to contact research staff if they were interested in participating in an interview. Demographic information was collected at each interview and included participants' age, gender, education level,

employment status, type of shift typically worked and years of nursing experience.

Five nurses provided their signed informed consent to participate in both semi-structured interview cycles. The interview questions were pre-drafted open-ended questions to ensure that nurses could express their responses freely. The first cycle of interviews was conducted from April to June 2018 to obtain nurses' feedback on the eLearning oral health education module. The second interview cycle took place from September to

October 2018, where the same nurses shared their experiences interacting with a dental hygienist in the LTCH. The participating nurses were 29–48 years old, and they had 4–19 years of nursing experience.

## 2.4 | Data analysis

### 2.4.1 | Quantitative data

Descriptive summaries of the data included means, standard deviations (SD), medians, interquartile ranges (IQR) and percentages. Pearson correlations were used to assess the strength of the association of the nurses' responses to selected post-training and feedback questions.

A modified Poisson model (MPM) was used to compare the nurses' per cent correct answers for each pre- and post-training question. The models tested whether the ratio of post-training percent correct answers over pre-training percent correct answers was significantly different from 1. The models used generalized estimating equations with a compound symmetry working correlation matrix.

RAI-MDS data from the oral health subsections were extracted from the EMR. Inter-rater reliability comparison of scoring between the nurses and dental hygienist for the oral health assessment was conducted. Exact McNemar tests were used to assess agreement in the item ratings (yes/no) of the RAI-MDS oral health assessment as well as an assessment of mouth pain between the specialized nurse assessor and the dental hygienist. The items 'daily cleaning of teeth or dentures, or daily oral care by bedtime—by resident or staff' and 'none of the above' were reverse-coded to 'less than daily cleaning of teeth or dentures' and 'any of the above', respectively.

### 2.4.2 | Qualitative data

Ten semi-structured interview recordings were transcribed using InqScribe (InQuirium, Chicago, Illinois, USA). The transcripts were coded by two independent researchers (KJ and CEG) using NVivo v. 11 (QSR International, Burlington, MA, USA). Coding and analysis followed the process described by Saldana.<sup>28</sup> During first-cycle coding, in vivo codes were generated based on participants' words to 'honor and prioritize the participant's voice'.<sup>28</sup> Evaluation codes were generated to reflect sentiments about the value or merit of the interventions as well as the self-reported benefits of each (Table 6). During second-cycle coding, pattern codes aligned with the quantitative outcomes of interest were deductively generated to group and consolidate the initial set of codes based on their similarity. Descriptive thematic analysis was undertaken to identify, analyze, and report higher-level patterns (themes) within the data (Table 6). The researchers met to compare and achieve consensus on the final themes. As per convergent mixed-methods design, the

qualitative and quantitative results were jointly reported, as the qualitative data contextualized and provided insight into the quantitative results.<sup>19</sup>

## 3 | RESULTS

### 3.1 | Intervention 1—RAI-MDS oral health assessments

#### 3.1.1 | Resident demographic characteristics

A cohort of 611 residents from the LTCH was followed up from July 2017 until August 2018 as part of the broader QI initiative reviewing oral healthcare practices. Only the 577 of 611 residents had at least one full RAI-MDS assessment, including an assessment of their dental status during this follow-up period, and were included in the analysis. The median length of follow-up for this group was 1.2 years ( $n=577$ , IQR 0.6–1.2) for a total of 523 person-years of follow-up.

The mean age of the residents was 87.2 (SD=9.5,  $n=577$ ) and most were female (67%). One-third (33%) of the residents were classified as having severely impaired cognitive skills, almost half (46%) as moderately impaired, and the remaining proportion (26%) were classified as independent or modified independent. Almost nine in 10 (87%) of the residents had extensive or total dependence with respect to self-performance in personal hygiene, while the remaining 13% needed supervision or limited assistance or were independent.

#### 3.1.2 | RAI-MDS dental status

Around 66% of the 577 residents had at least one oral health issue recorded on their first full RAI-MDS nurse assessment. 'Dentures and/or a removable bridge' (43%,  $n=577$ ) and 'some or all-natural teeth lost (without using dentures)' (25%) were recorded most often, while all other issues (e.g. carious teeth, inflamed gums or mouth pain) were recorded for less than 3% of the residents. In comparison, the dental hygienist recorded at least one oral health issue for nearly 99% of the residents who were reassessed, which was significantly higher ( $P<0.0001$ ,  $n=65$ ) than the 66% reported by the nurses for this sample. The dental hygienist also recorded a higher prevalence of all oral health issues (all  $P<0.0001$ ) except for 'having dentures and/or a removable bridge' ( $P=0.29$ ) and 'mouth pain' ( $P=1.0$ ) (Table 2). There were no significant differences in age, sex, cognitive skills and self-performance of personal hygiene for the sample of 65 residents versus the 512 residents who were not selected (all  $P>=0.44$ , results not shown).

### 3.2 | Intervention 2—Oral health education

The median age of nurses who responded to the demographic survey questions was in the 40–49 age category ( $n=51$ ) (Table 3). Most



nurses were female (92.6%,  $n=54$ ) with a median of 16 years of education ( $n=50$ ). Most indicated that English was not their primary language (63.6%,  $n=22$ ).

Around half of the nurses (49.1%,  $n=53$ ) worked part-time, 39.6% worked full-time, and the remaining 11.3% worked as casual employees (Table 1). Around 43.6% of the nurses ( $n=55$ ) typically worked day shifts, 34.5% worked evening shifts, 12.7% worked night shifts and 9.1% worked all shifts. The median number of years of work experience was 11–15 years ( $n=55$ ).

### 3.2.1 | Knowledge quizzes

Six of the eight quiz questions were answered correctly over 80% of the time by the 60 nurses who completed the pre-training quiz (Table 4). A total of 71.7% of nurses correctly identified which oral healthcare approach to use when assessing residents on a daily basis, and 68.3% correctly answered that the number of times a resident's mouth has to be cleaned is twice a day. For the 51 nurses who completed the post-training quiz, there was a higher

TABLE 1 Overview of the three-cycle coding approach adopted in this study.

First cycle: in vivo code examples	Second cycle: evaluation codes	Third cycle: pattern codes (themes)
'Module was informative'	+Education: Informative	eLearning Module: Benefits
'More confidence'	+Education: Increased confidence	
New approaches to oral care 'Offers preventative information'	+Education: Learned techniques	
'Don't have much time'	–Education: Lack of time	eLearning Module: Implementation Barriers
'Keeps everyone accountable'	+OHAT: Increased accountability	OHAT Referrals: Benefits
'Assess then do the referral' 'Keeps everyone in the know'	+OHAT: Promotes referrals	
'Structured approach' to oral care 'Can assess urgency'	+OHAT: Thorough assessments	
'I don't know about it'	–OHAT: Lack of awareness	OHAT Referrals: Implementation Barriers
'Don't have time'	–OHAT: Lack of time	
Treats residents the same	–OHAT: Not resident-specific	
'We don't do mouth care'	–OHAT: Someone else's role	
'Professional advice' 'Gives us good tips'	+DH: Specialised knowledge	DH: Benefits
'Good for residents' Timely resident care 'Luxury' 'Interprofessional care' Ease of access to a DH	+DH: Improved resident care	
Good communication approach 'Communicates well with staff' Improved role clarity	+DH: Improved communication	
'We have more support' 'Great support'	+DH: Improved support for LTC teams	
DH unavailability—night shift Night shift is informed last	–DH: Limited availability	DH: Implementation Barriers
Costs of a DH	–DH: Financial costs	

TABLE 2 RAI-MDS assessments for a random sample of residents ( $n=65$ ).

Oral health issue	Nurse <sup>a</sup>	DH	P-value <sup>b</sup>
	%	%	
Debris present in mouth prior to going to bed at night	4.6	76.9	<.0001
Has dentures and/or removable bridge	36.9	43.1	.29
Some or all-natural teeth lost—does not have or does not use dentures (or partial plates)	30.8	83.1	<.0001
Broken, loose or carious teeth	3.1	46.2	<.0001
Inflamed gums (gingiva), swollen or bleeding gums, oral abscesses, ulcers or rashes	0.0	53.8	<.0001
Less than daily cleaning of teeth or dentures or less than daily mouth care—by resident or staff <sup>c</sup>	0.0	24.6	<.0001
Mouth pain	1.5	1.5	1.00
Any of the above <sup>c</sup>	66.2	98.5	<.0001

Abbreviations: DH, dental hygienist; IQR, interquartile range.

<sup>a</sup>Random subset matched to nearest full annual assessment (median date difference is 6 days, IQR 3–14 days).

<sup>b</sup>Exact McNemar's test.

<sup>c</sup>Reverse-coded.

TABLE 3 Nurse demographic characteristics.

Variable	Category	n	%	Total responding	% missing response <sup>a</sup>	% prefer not to answer <sup>a</sup>
Age (years)	<40	13	25.5	51	10.5	13.4
	40–49	21	41.2			
	50+	17	33.3			
Gender	Female	50	92.6	54	10.5	9.0
	Male	4	7.4			
Years of education	0–10	3	6.0	50	10.5	14.9
	11–15	22	44.0			
	16–20	17	34.0			
	21+	8	16.0			
Type of nurse	RN	14	21.2	66	1.4	0.0
	RPN	52	78.8			
Employment	Full-time	21	39.6	53	10.5	10.5
	Part-time	26	49.1			
	On call	6	11.3			
Shift typically worked	Day shift	24	43.6	55	10.5	7.5
	Evening shift	19	34.5			
	Night shift	7	12.7			
	All shifts	5	9.1			
Years of work experience	0–5	12	21.8	55	10.5	7.5
	6–10	9	16.4			
	11–15	12	21.8			
	16–20	10	18.2			
	21+	12	21.8			

<sup>a</sup>Based on a total sample size of 67.

percentage of correct responses for the six questions. There was no significant change in their post-training quiz performance compared to the pre-training quiz.

### 3.2.2 | Satisfaction with the eLearning

Overall, the nurses were satisfied with the eLearning module (mean rating 4.1 out of 5, SD=0.8, n=52; Table 5). The highest mean agreement ratings were for the content enhancing their knowledge of oral healthcare (mean=4.2) and oral care delivery methods (mean=4.1). The lowest mean agreement rating, between 'neutral' and 'agree', was for how easy it was to complete the education (mean=3.7). The remaining mean ratings were close to 4 out of 5.

The nurses who completed the post-training survey also indicated that the online education session was useful (n=51, mean=8.6 out of 10, SD=1.5) and provided new information to assist in delivering oral care. When exploring the feedback provided during the qualitative interviews, the nurses reported that they saw value in the eLearning education on oral health among residents and would like to access the eLearning as a refresher as frequently as 'every 6 months because new [residents] come'. The nurses further expressed that they would have benefitted from

in-person coaching and real-life demonstrations on how to apply this learning in practice:

I honestly thought it would have been a good idea to actually have a live visual, like an actual example of what [the content] means. I thought if [the dental hygienist] actually walked us through it – where you actually have clients that have different issues, gum disease, or cavities, ... or have an actual person, 'this is what you are looking for.' Have an actual screening rather than go through it step-by-step video format.

However, the nurses also expressed that time constraints and high workloads affected their ability to learn the content in the module, which may explain the non-significant difference between pre- and post-knowledge quiz scores:

We don't have much time for the that online stuff. We do as best as we can, but usually [eLearning is] done quickly just to pass through it, so I don't see a lot of impact of it. It's okay to have any education. Sure, it's good. But, I mean, the one that that is provided at the point of care is much better and using much better ideas to tell you the truth.



TABLE 4 Nurse quiz – percent answered correctly.

Question	Pre per cent correct (n = 60)	Post per cent correct (n = 51)	P value <sup>a</sup>
1. As a healthcare worker, what categories are you using to assess your clients on a daily basis?	71.7	78.4	.40
a. Lips, tongue, gums and tissues			
b. Saliva and oral cleanliness			
c. Natural and/or dentures, as applicable, for the client			
d. Dental pain			
e. All of the above <sup>b</sup>			
f. Answers a, b and c only			
2. What steps can you take to clean the mouth of a frail client with a full set of dentures?	83.3	78.4	.52
a. The client does not eat through their mouth so they don't need daily cleaning			
b. Sit behind the client and with your non-dominant hand, hold and support the client's head			
c. Gently wipe the client's mouth with a warm washcloth using your dominant hand, while ensuring to clean the inner cheeks, tongue, gums, the roof of the mouth and under the tongue			
d. Answers b and c only <sup>b</sup>			
3. How many times a day should you clean a resident's mouth? (Correct response: 2)	68.3	78.4	.14
4. What is the best method for removing oral bacterial plaque?	83.3	80.4	.65
a. Toothpaste			
b. Using a medium-bristle toothbrush			
c. The mechanical action of brushing <sup>b</sup>			
d. All of the above			
e. None of the above			
5. It is necessary to wear proper personal protective equipment	85.0	92.2	.21
• True <sup>b</sup>			
• False			
6. When approaching someone with dementia it's important to:	88.3	90.2	.68
a. Speak very loudly as the resident is likely hard of hearing			
b. It is best to provide an individual approach as every resident has different needs			
c. It does not matter as their dementia has no impact on their care			
d. Approach them in a calm manner and validate the reality they are experiencing			
e. b and d <sup>b</sup>			
7. Which of the following responses is NOT true about providing mouth care to residents in long-term care?	83.3	86.3	.53
a. Only residents with teeth require mouth care <sup>b</sup>			
b. Mouth care should be provided twice a day to all residents			
c. Mouth care can be done anywhere the resident is comfortable			
d. The primary goal of mouth care is to disrupt bacteria plaque colonies within the mouth			
8. Soft broken-down areas on tooth surfaces:	81.7	86.3	.28
a. Are a normal part of aging			
b. Could be a sign of a cavity <sup>b</sup>			
c. Indicate a strong enamel surface			
d. None of the above			

<sup>a</sup>P-values from Modified Poisson models.<sup>b</sup>The correct response option, where applicable.

### 3.3 | Intervention 3—Integrating dental hygienist knowledge into the interprofessional LTCH team

Among the 60 nurses who completed the eLearning module pre-surveys, 18.3% were previously aware of and had used the OHAT, 33.3% were previously aware of it but had not used it and 48.3% were unaware of it. Among the 51 nurses who completed the post-survey, many were very comfortable with being able to start using the OHAT as part of their assessment routine (mean=8.3 out of 10,

SD=1.8). Initially, referral rates to the dental hygienist were low. As such, the dental hygienist implemented KM strategies to conduct in-person, pre-scheduled rounds with nurses during various shifts, which improved the frequency of referrals. However, overall, the uptake of the OHAT was poor.

These findings were corroborated by nurses' qualitative feedback. During the interviews, most nurses reported that the OHAT was a useful tool as, 'It's good and it gives a score [...] [on] your client's mouth, kind of overall health'. They explained that by having insight into their

TABLE 5 Nurse feedback (n = 52).

Agreement with	Mean <sup>a</sup>	SD
I am satisfied with the training I received for oral care delivery prior to the online education session	4.0	0.9
The content in the online education session enhanced my knowledge of oral healthcare for long-term care residents	4.2	0.8
This online education session has addressed my learning needs	4.0	0.9
The material presented in the online education session was clear and easy to understand	4.0	0.9
I will be able to share the knowledge I gained from the online education session with others	4.0	0.9
The use of case studies in the online education session helped me gain a better understanding of how to deliver oral care to clients	4.0	0.9
The online education session prepared me to use the new screening tool	3.9	0.8
This online education session will enhance my oral care delivery methods	4.1	0.7
The visual quality of the online education session was satisfactory	4.0	0.8
The audio component of the online education session was satisfactory	4.0	0.8
It was easy for me to complete the online education session	3.7	1.0
I would recommend this online education session to others in my field of work	3.9	0.9
Overall, I was satisfied with the online education session	4.1	0.8

<sup>a</sup>1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree.

clients' oral and overall health, they were able make decisions as to when they 'can do the referral or tell the dentist that [the resident] needs to be looked at'. However, despite their positive attitudes towards the OHAT, most respondents indicated that they did not adopt this tool in practice. Two barriers to adoption emerged: first, nurses reported that they often experienced time constraints, saying that '... if something happens, the PSW reports to us; we are going to check [the resident]. But normally, we don't have time to do [the OHAT assessment]'. Second, the nurses reported being unaware of the tool: '[the OHAT] is for dental hygienists. I didn't know it's for nurses'.

Given these results, the dental hygienist decided to implement the SBAR (Situation, Background, Action, and Response) as a new referral tool in future iterations of the program, which were out of scope of this study. The SBAR is used to tell a story about a specific issue and generate a team response.<sup>29</sup> It is used at this LTCH to communicate other health concerns. This study enabled the dental hygienist to repurpose its application within the context of oral health concerns (Figure 4).

### 3.4 | Value of incorporating the dental hygienist in LTCH

During the second round of interviews, the nurses reflected on their experiences of having a dental hygienist on the unit. They shared that they valued having another interdisciplinary team member providing oral care for residents 'because we are working in a team. [...] First PSW do their job, and then if something happens, they report to me, and I do my job and I report to you [the dental hygienist]. You are doing something that you think is needed for the resident. And we are a team. We have to work together'.

The reported benefits of having a dental hygienist on the interdisciplinary care team were twofold: first, the dental hygienist was viewed as a valuable educational resource who nurses could consult to provide insight into best practices related to the oral healthcare of older adults:

I think it is awesome to have a dental hygienist on the floor. I think it is great, you know, sometimes just knowing that the person is there or that they are going to be there this week. Sometimes you are just going to have some questions. Sometimes knowing that the dental hygienist is going to be on the unit, at home you start thinking about questions, and you become prepared.

Many times, when they see [dental hygienist] they can ask the questions. That is why it is important for the person to be visible, because it does save us time. [...] Sometimes the dental hygienist is a specialist, and they can show techniques and come up with ideas right then and there.

Second, the dental hygienist was deemed to be a valuable team member who demonstrated and offered guidance on how to address complex oral care issues or challenges:

[The dental hygienist provided] education with the staff about best mouth care for a challenging client who wouldn't open their mouth. [The resident] has Parkinson's [...], needs oral care and the family is concerned. So, that was initiated by the PSW [...]. And I think [the PSW] was excited [that the dental hygienist was able to assist with resident care].

## 4 | DISCUSSION

This study evaluated integrating a dental hygienist into an interprofessional LTCH team as the impact and the resources needed to support nurses in this process. The involvement of dental hygienists on the care team can help support LTCH staff in identifying residents'

TABLE 6 Qualitative themes, evaluation codes and sample quotes for each evaluated intervention.

Intervention	Pattern Code (theme)	Evaluation code	Example quotes
Intervention 2: eLearning Module	eLearning module: benefits	+Education: Informative	'Also from the nursing aspect, when you get gum disease, [the module] goes into 'You can get heart attacks, strokes,' ... so it was informative'
		+Education: Increased confidence	'With this information, I'm more confident. ... This [education module], gives me more confidence'
		+Education: Learned techniques	'I like the approach where they kind of say, Go from behind and you use your dominant hand to brush [the resident's teeth] and use circular motions. ... And even if [the gums are] bleeding, you keep continuing to brush. ... As long as you let them know what you're doing'
	eLearning module: implementation barriers	-Education: Lack of time	The modules offer 'preventative [information] for injuries for the nurses, cause you have patients that bite. Or when you're doing it improperly, then [the PSWs] can get hurt, so it helped'
Intervention 3: OHAT referrals	OHAT referrals: benefits	+OHAT: Increased accountability	'[The OHAT] makes sense. It shows that [the oral health issue] has been reported, and it shows that it has been reported all at once. That is the best thing. I think it's great because it goes back to keeping everybody in the know, and keeping everybody that you know accountable. We all know we have to follow-up; if it goes slipping through the crack with one person, if the nurse didn't report it or contact the dental hygienist, then we know that all three people know'
		+OHAT: Promotes referrals	'For assessments, at least we have the [OHAT] tool, so we can go back and look at that ... You use the [OHAT] assessment and orally look in and see what's going on, and then you can do the referral, or tell the dentist that [the resident] needs to be looked at'
		+OHAT: Thorough assessments	'Now when I look in somebody's mouth, when there is an admission as I told you, ... I look at the person, like, the whole thing. So, mouth care, I can't say that I'm using the scale 100%, but I have a structured approach to how to see the resident's mouth'
	OHAT Referrals: Implementation Barriers	-OHAT: Lack of awareness	'this [OHAT] is for the dental hygienist. I don't know it's for nurses. I'm not sure about that part'
		-OHAT: Lack of time	'normally we don't have time to do that [fill out the OHAT online]. I think better to dental hygienist to do that one'
		-OHAT: Not resident-specific	'The only thing like assessing dentures, for the client who doesn't have dentures, [the OHAT] doesn't identify, like doesn't have dentures. And it treats you like everyone has dentures should be the point where you can say no dentures'
		-OHAT: Someone else's role	'As a nurse, usually we don't do mouth care; usually PSW does the mouth care. If they see something unusual, then they report to us, and then we have to refer to the dentist or something like that. ... The process is here, we notify the doctor; doctor puts consult for dentist, and then it goes by the MD'
Integrating a DH into the Unit	DH: Benefits	+DH: Specialised knowledge	'Beautiful. I love [the dental hygienist on the unit]. It's professional advice, sure. I don't know how much a dental hygienist would know how to care for someone with dementia, but at least give us good tips for ourselves and other residents'

(Continues)

TABLE 6 (Continued)

Intervention	Pattern Code (theme)	Evaluation code	Example quotes
		+DH: Improved resident care	'I think it's a great idea [to have the dental hygienist on the unit]. ... It's a good idea to do that. They [the residents] like that. I mean, they're older now and it's harder for them to go out downstairs or come out of their rooms, especially on my floor where they are socially isolated, ... so it works for them. When they [the dental hygienist] come[s] up, they [the residents] don't have to feel like they have to get dressed and go downstairs; somebody is coming to their comfort zone, as opposed to them going down and waiting. They like that they come to their room'
		+DH: Improved communication	'[The dental hygienist] has a good approach. I met [the dental hygienist] already, [they have] come on the floor and communicates very well with the staff and lets us know. There's always room for improvement in the communication, but I think [the dental hygienist has] done an excellent job. Actually [the dental hygienist has] come to the nursing station a few times, "We tried this approach," you know? And [they] even call the PSW, "come and see what we're doing," or "if you can help or let me know any barriers that I might need to know so I can effectively do my job, so I can help you effectively do yours," and I mean [the dental hygienist has] done that'.  'because we are working in a team. [...] First PSW do their job, and then if something happens, they report to me, and I do my job and I report to you [the DH]. You are doing something that you think is needed for the resident. And we are a team. We have to work together'
		+DH: Improved support for LTC teams	'I think sometimes we get so carried away with our daily routine ... Sometimes you can't send that email or make that phone call. So just visually seeing that person [the dental hygienist], you can ask questions and get questions answered, and I know that person is available'.  'We have a dentist, and hygienist, and dental clinical not far from our nursing home; not everybody has the luxury of that. Otherwise, if you can get the dental hygienist on the spot who can do that those assessments, and help, and education, sure. It's a great program. ... And I hope that's not the end of it. I mean we need more support. ... Would the dental hygienist still be available if we need them? ... We loved it. We loved it, and we want to continue because, you know, we get admissions and we get more client change, and we need some support. This was a great support. So, we need more'.
	DH: Implementation Barriers	-DH: Limited availability	'I feel like everything happens in the day and so I was more inclined with what is going on. And now I am evening [shift] and I feel lost, like I didn't even know that we are taking this approach [with the dental hygienist]. ... We sometimes get informed last and we don't know what is going on. ... I mean, we are nurses that work evenings. Night shift is fine because they don't do that kind of care, and the morning shift, they benefit from all the things with families and the dental hygienist'.
		-DH: Financial costs	'[...] because the dental hygienist, it costs, right? [Residents] have to pay from their pocket. ... We have to contact the family first before we contact the dental hygienist or dentist. ... The nurses have to contact the family members. ... If we contact directly the dentist or dental hygienist and then they charge [the resident], then they get mad ... The issue comes to us, not the dentist or dental hygienist'

**Situation**

**A. Oral Health Referral**

1. The resident requires oral care for

- ☐ 1. Urgent Care
- ☐ 2. Preventative Care

2. The reason is

- ☐ 1. Changes to oral health
- ☐ 2. Dental Hygienist professional cleaning
- ☐ 3. 1:1 Coaching on oral care delivery

3. The resident performs or receives regular oral care every:

- ☐ 1. 2 times a day
- ☐ 2. Daily
- ☐ 3. 2-6 times a week
- ☐ 4. Less than once a week

4. The resident performs or receives oral care by

- ☐ 1. Self
- ☐ 2. Assisted

5. The last time a dentist or dental hygienist has seen the resident was

6. Others concerned about the resident's oral health:

- ☐ 1. Family
- ☐ 2. RN/RPN
- ☐ 3. PSW
- ☐ 4. Physician
- ☐ 5. Other

7. If other please explain

8. The concern(s) for the resident's oral health is/are:

- ☐ 1. Visible plaque accumulation
- ☐ 2. Gingivitis (swollen/bleeding gum)
- ☐ 3. Resident won't open their mouth
- ☐ 4. Dentures cannot be taken out or put in resident's mouth
- ☐ 5. Resident refuses oral hygiene care
- ☐ 6. Resident bites toothbrush/caregiver
- ☐ 7. Resident kicks or hits out
- ☐ 8. Resident cannot rinse and/or spit and swallows all liquids/toothpastes

9. Based on the above, I request for:

- ☐ 1. Dental Hygienist Consult

**Response**

**Dental Hygienist called in to complete oral health assessment**

**FIGURE 4** Situation, background, action, response (SBAR) built into electronic medical record.

oral health concerns and improve residents' oral health. Dental hygienist interventions can help reduce plaque accumulation,<sup>17</sup> and oral health management by dental hygienists has been associated with a lower incidence of pneumonia in LTCH.<sup>16</sup> Dental hygienists are well suited to formulate oral care treatment plans that are targeted to the needs of LTCH residents.<sup>14,15</sup>

Implementation of a dental hygienist into LTCH primary care is warranted. When comparing RAI-MDS assessments completed by the nurses and dental hygienist, the results showed that the dental hygienist identified significantly more oral concerns compared

to nurses, implying that some oral concerns might go unreported. Similar findings of undetected oral problems using the RAI-MDS have been reported by Hoben et al.<sup>30</sup> and Krausch-Hofmann et al.<sup>31</sup> One recommendation is to delegate the oral health assessment of the RAI-MDS (Section L) to a dental hygienist. Traditionally, nurses complete most resident assessments in LTCH. However, the results reported here suggest the importance of having experts in that field to provide support to RAI-MDS nurse assessors. For example, it was recommended as best practice in Ontario to have dietitians' complete sections of the RAI-MDS assessments that pertain to

residents' diet type.<sup>32</sup> Similarly, dental hygienists can fill out corresponding oral health sections in the RAI-MDS assessment to accurately report on the oral status of residents, which would lessen the workload of LTCH nurses.

This project resulted in the creation of an interactive eLearning resource that LTCH staff can access to review oral care practices and assessments. Our results demonstrated that education was satisfactory but insufficient. LTCH nurses were satisfied with this module and recommended that it be available as an annual or biannual 'refresher' on best oral care practices for residents. The nurses' scores from the post-eLearning quiz demonstrated that they were knowledgeable about basic oral assessments. However, it was clear from the interviews that the nurses preferred greater in-person support from a dental professional when assessing the diverse oral health concerns of residents. Given the complex needs of residents in LTCH, the nurses identified the value of having a dental hygienist on the unit to provide coaching and customised care plans regarding residents' oral care. Having a dental hygienist on the care team will mean that LTCH staff can address dental questions more quickly and that residents' oral concerns are not overlooked.

Providing adequate oral care to residents involves completing accurate and reliable oral health assessments. The OHAT is a reliable and valid screening tool that is used to identify dental concerns and is specifically geared toward non-dental professionals in LTCH.<sup>27,33</sup> Although nurses anticipated a high level of comfort to start using the OHAT, it was clear from the OHAT referral rates and from the qualitative data that this tool was underutilised. In some cases, staff were not even aware that the OHAT was available through the EMR. Thus, in consultation with the KM specialist, it was realised that a simple, easy-to-use referral tool was needed. This led to the development of the oral care version of the SBAR tool, which can be used by LTCH nurses to call upon the expertise of a dental hygienist. The SBAR is a more appropriate tool than the OHAT, as it permits nurses to share residents' oral health concerns without having to complete an assessment. The SBAR tool is currently used to report other health concerns at our LTCH, and it was therefore easier to integrate into existing communication processes. The SBAR prompts one of two responses from the dental hygienist:

1. To conduct an oral assessment when there is a change in oral health status. The dental hygienist can either address the concern or refer the resident to a dentist in a timely manner.
2. To provide extra support or coaching to primary care providers on providing daily oral hygiene; this may include designing individualised care plans for residents.

Numerous barriers prevent residents in LTCHs from receiving the best possible oral care.<sup>32</sup> Time constraints and busy workloads were some of the key barriers identified by nursing staff throughout this study. This study indicates the need to provide additional support to LTCH clinical staff when managing residents' oral health. This need is even greater after the COVID-19 pandemic.<sup>34</sup>

LTCHs have experienced high staff turnover rates with nursing staff leaving the LTCH sector due to burnout from the pandemic. Integration of a dental hygienist into LTCH would fill this gap and enable improved resident oral health. Increased dental hygienist presence on the LTCH unit could facilitate nurse training in oral assessments. Accurate assessments could increase dental hygienist referrals and subsequent treatment by either a dental hygienist or dentist. Additional benefits could include reduced healthcare costs associated with the management of chronic diseases, and reduced transportation costs associated with travel to external dental clinics, as residents may be eligible to receive treatment from an onsite dental hygienist. LTCHs should conduct a cost-benefit analysis to determine the impact of incorporating a dental hygienist into LTCH primary care teams. Further research is warranted to explore the sustainability of this model and to determine whether other approaches can be adopted to integrate dental hygienists into an LTCH team.

This study was a sub-study of a larger QI initiative; consequently, it produced rich information from multiple data sets including quantitative, qualitative and KM measures. The study was complex but meticulous in its initial design of the experimental protocol. There were a few limitations associated with this study. First, the dental hygienist who performed the dental health assessments was a member of the research team, leading to a potential research bias. Second, there was a low sample size of nurses interviewed, which may have validity implications.

## 5 | CONCLUSION

This study showcases the feasibility and desirability of an oral health eLearning module, practical screening tools and participation of a dental hygienist on the interprofessional team at an LTCH. Observed benefits were improved knowledge of oral health, improved assessments and increased engagement of the dental hygienist through referrals. Future research should explore the sustainability of having a dental hygienist on the team as well as the validity of the newly developed oral health SBAR tool in facilitating referrals to a dental hygienist.

## AUTHOR CONTRIBUTIONS

NVS secured funding, co-designed the quality improvement (QI) initiative, contributed to the research design, provided data for Table 1, and contributed to the writing of the manuscript; KS contributed to the research design, collected data, conducted the nurse interviews, conducted the thematic qualitative analysis and contributed to the writing of the manuscript; SG contributed to the research design, conducted all statistical analyses and contributed to the writing of the manuscript; JS secured funding, co-designed the QI and contributed to the research design; CEG conducted the qualitative thematic analysis and contributed to the writing of the manuscript; RA contributed to the research design; DC provided interpretation of the data. All authors reviewed and approved the submitted version of the manuscript.



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## CONFLICT OF INTEREST STATEMENT

The authors do not report any conflicts of interest.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author, NVS, upon reasonable request.

## ETHICS STATEMENT

This study was approved by the Baycrest Research Ethics Board (#17–50) on February 6, 2018.

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