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Domiciliary Dentistry: A Multiple Case Study in the Province of Quebec, Canada

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Abstract

Background

The demand for more flexible and person-centered models of oral healthcare delivery is increasing and while mobile and domiciliary dental services have the potential to increase access to oral healthcare among dependent elderly and people with disabilities; the uptake of this service model by dentists remains low. Therefore, the aim of this study was to closely examine existing mobile clinics that are leading the practice of domiciliary dentistry in a specific context.

Methods

We used a qualitative descriptive multiple case study design. We studied three independent domiciliary dentistry clinics in the province of Quebec, Canada. Data were collected using non-participant observations and semi-structured interviews with dental professionals, patients, and caregivers. We performed a qualitative content analysis using a deductive/inductive coding framework.

Results

We presented a detailed description of the physical and service features of the studied cases. Physical features included the set-up of the mobile clinics, the portable equipment used, and the domiciliary locations of visits. For service features, we described the roles, attitudes, and interactions among those involved on both the providers' and recipients' sides, as well as, the logistical and financial aspect of the domiciliary dental services.

Conclusions

This case study showed domiciliary dentistry to be feasible, profitable, and highly valued by a growing segment of the population. Additional research in different contexts would further contribute to building evidence-based models to help increase the uptake of this type of practice by current and future dental professionals.

Background

Ageing increases the risk of physical, cognitive, and functional decline, which in turn poses challenges in accessing conventional oral healthcare systems (i.e. fixed dental clinics). In western societies, the elderly population is growing and what used to be coined as the population "pyramid" is rapidly broadening at the top tier (1). Also, more people are keeping their natural teeth into old age, which is increasing the demand for oral healthcare.

In response to the health-related challenges faced by aging populations, the WHO developed an action plan and strategy on ageing. This action plan prepares for a "decade of concrete global action (2020–2030)", which the WHO had declared as the decade of *Healthy Ageing*. It includes ten priorities for action,

among which one is to align health systems to the needs of older people where “older adults get the health care they need -where and when they need it” (2). This priority for action is particularly relevant in dentistry because, for dependent elderly living at home or in long-term care facilities (LTCFs), accessing traditional dental clinics is challenging and sometimes impossible.

One way to respond to this problem, especially for the dependent elderly, is to support the practice of mobile dental services. This idea is not new: back in 2001, Lee and Thomas wrote that “as our population ages further, portable and mobile dentistry will be a necessity, not a luxury” (3). It is important to mention that mobile dentistry is an umbrella term for different mobile systems such as equipped vans or domiciliary (also called “portable”) dental services. More specifically, domiciliary dentistry is “a service that reaches out to care for those who cannot reach a service themselves. (It) is intended to include oral healthcare and dental treatment carried out in an environment where the patient is resident either permanently or temporarily, as opposed to that care which is delivered in dental clinics or mobile units (vans). It will normally include residential units and nursing homes, hospitals, day centres and patients’ own homes” (4).

Unfortunately, 20 years after Lee and Thomas’s call, domiciliary dentistry is still in low supply as only a small number of clinicians are leading this kind of practice. The literature cites dental professionals' negative attitudes towards mobile services as an obstacle that impedes their adoption of domiciliary dentistry (5, 6). Such negative attitudes may be due to logistic and financial concerns but also a lack of training and the apprehension of serving people with complex medical conditions (7). Moreover, we lack models of practice for domiciliary dentistry that could encourage dentists to adopt this approach and guide them in its implementation.

With evolving demographics, we need to propose alternative models of oral health care services. This is one of the goals of our research program named ACE-Dent (Accessible Clinics and Equity in Dentistry) (8). More specifically, the aim of this study was to understand how existing domiciliary dental services operate within a particular context in order to inform the development of practice models and provide evidence-based recommendations.

Methods

Research Design

We conducted a qualitative descriptive multiple case study, which Yin (2014) described as the investigation of contemporary phenomena in real contexts (9). In our research, we were interested in domiciliary dentistry in the context of private dental care in the Canadian province of Quebec. Quebec is the second most populated province in Canada with a population of approximately 8.5 million. In 2020, the percentage of 65 years and over in Quebec was approximately 20% of the total population (10).

We defined a “case” as any mobile dental clinic providing domiciliary dental services. Referring to the Model of Competence (11); a conceptual framework on person-environment interaction, each case was

bounded by human and nonhuman (physical) elements including the dentist(s) and other members of the dental team (i.e. dental assistants and administrative staff), as well as the equipment and the environment in which the dental services were provided.

Ethics

We obtained human research ethics approval from the Institutional Review Board at McGill University, Montreal, Canada (IRB Study Number A06-E50-18B). Informed consent was obtained from all participants and all methods were carried out in accordance with relevant guidelines and regulations.

Data Collection

We first identified 2 cases (mobile clinics) in the province of Quebec. We conducted non-participant observation and semi-structured interviews with the dental professionals, and when feasible, with patients or their caregivers. Observations were recorded in the form of hand-written field notes and interviews were audio-recorded for analysis purposes. We then identified a third case. However, this came during the COVID 19 pandemic; therefore, data collection for this case was solely through online interviewing.

Observations. We completed observations of 27 domiciliary visits, four of which were in private homes and the remaining 23 in LTCFs. The non-participant observations consisted of a member of the research team accompanying the mobile dentist/dental team on select days and observing multiple visits in LTCFs or private homes. The observations took place over ten non-consecutive days. We observed the process of transporting equipment, setting up in a domicile, delivering care, and transitioning between appointments. Consent was sought from dentists and other dental-team members prior to beginning the research. Before entering a domicile, particularly private homes, the dentist would inform the patient or a family member about the research and ask for their permission to allow the researcher into their home/room. After that, the researcher sought their formal consent.

Interviews. We used a combination of semi-structured interviews and informal discussions with five dentists (three owners and two associates), one dental assistant, and two administrators. Interviews with the dental professionals took place whenever it was convenient for the participants to chat; between appointments, during breaks/lunch, in the car while commuting to see patients, and over the phone or videocalls (outside working hours). Interviews with patients or caregivers took place at the domicile, right before or after they interacted with the dentist. When patients were cognitively unable to participate in interviews, we asked to interview the caregiver. In total, we formally interviewed four caregivers and two patients. We used two semi-structured interview guides: one for the dental team and another for the patient/caregiver. For the dental teams, we used open ended questions to elicit an in-depth description of the features of domiciliary dentistry including the physical environment, the delivery of care, and interactions with patients and other team members. For patients, the interview guides included questions about their health conditions, why and how they sought domiciliary dental care, and what the experience of domiciliary dentistry meant for them.

Data Analysis

We conducted a qualitative content analysis of the field notes and transcribed interviews. We developed and refined a coding frame to represent the analytical framework (Table 1). The content analysis followed a combination of deductive and inductive coding. The deductive categories (i.e. the distinction between physical and service features) were guided by Rousseau et al.'s Model of Competence (11). We defined "features" as the characteristics and presentation of the physical and human environments of the bounded cases. NM followed an iterative process of immersion in the text, coding, and theme extraction. This process was supplemented with regular discussions and consultations with other research team members.

Table 1
Coding frame for data analysis

Features of Domiciliary Dentistry (DD)		
Categories	Themes	Codes
Physical features	Domiciliary Dentistry setup	- The "dental office"
		- Equipment
		- Domiciles (Homes or LTCFs)
Service features	Main actors: roles, attributes, and attitudes	- Roles of service providers
		- Attitudes and attributes of providers
		- Patients and patients' networks
		- Attitudes of patients and caregivers
	Interaction, logistics and treatment	- Interaction: dental team, patients, and others involved
		- Scheduling and planning visits
		- Accessing the domicile
		- Setup and treatment
		- Financial aspects

Results

We studied three independent cases that we will refer to as clinics A, B, and C (Table 2). Clinic A had been operating for over 30 years and, at the time of the study, consisted of a dentist (owner), five associate dentists working part-time (two to three days per week), and two administrators who worked from their homes. Clinic B had been operating for only a year and a half and consisted of a dentist (owner), a dental assistant, and a secretary who worked from home. Clinic C had been providing domiciliary services for

five years. It consisted of a dentist (owner), a dental assistant, a secretary who worked “on site” (by accompanying the dental team on all visits), and a part-time administrative assistant who worked evenings (from home) managing emails, voicemail, and other administrative tasks.

Table 2
Description of Cases

Characteristics	Clinic-A	Clinic-B	Clinic-C
Years in operation (at time of study)	30 years	1.5 years	5 years
Mobile team members (on-site)	Dentist (owner) Five associate dentists (part-time basis) Two dental assistants (rotating between associate dentists)	Dentist (owner) Dental assistant	Dentist (owner) Dental assistant Secretary
Remote team members	Two administrative assistants (full-time)	Secretary (full-time)	Administrative assistant (part-time)
Equipment	One portable dental unit with stacked storage case (custom-made) One backpack	One portable dental unit (purchased commercially) One rolling suitcase + backpack Laptop computer	Two portable dental units with stacked storage cases (custom-made) One rolling suitcase Laptop computer Defibrillator
Schedule of service delivery	Owner: 4 days per week Associate dentists: 2–3 days per week	5 days per week	4 days per week
Domiciliary service locations	LTCFs (mainly public) and some private homes	Mainly private homes and some private LTCFs	LTCFs (mainly private)
Dental services provided	Preventive services (i.e. examination and cleaning) Dental fillings Tooth extraction Denture repair Scaling and abscess drainage	Preventive services (i.e. examination and cleaning) Dental fillings Tooth extraction Denture repair Scaling and abscess drainage	Preventive services (i.e. examination and cleaning) Dental fillings Tooth extraction Denture repair Scaling and abscess drainage

Characteristics	Clinic-A	Clinic-B	Clinic-C
Fees	Follows syndicate fee guide (Does not charge a fee for displacement)	Follows syndicate fee guide + Flat displacement fee per patient	Follows syndicate fee guide + Flat displacement fee per patient

In the next sections, we will describe the physical and service features of the clinics we studied. In terms of the physical environment, we will describe what constitutes the “dental office” in domiciliary dentistry; the equipment used; and the domiciliary settings where service is provided. In terms of service features, we will identify who is involved and how; interaction and communication between those involved; what constitutes domiciliary visits; and the financial aspects of this service.

Physical Features

Domiciliary Dentistry Setup. The “Dental Office”. There were three spaces that constituted the physical environment of the mobile clinics: a garage, the patient’s domicile, and the secretary’s own home (not observed). Each clinic had a dedicated garage space for equipment storage and sterilization (in dentists’ own-homes or a rented garage space); visits were carried out in the patients’ homes or in LTCFs; and clinics’ administrative staff used their own homes as their workplace (except one secretary that traveled with the dental team).

Equipment. With the exception of portable x-ray devices, which were prohibited by the Quebec government for use in domiciliary settings; the mobile dentists used portable dental units and all the necessary instruments and materials found in a conventional dental clinic setting. We observed two types of portable dental units: Clinic B used a commercial brand that consisted of an aluminum case that was 12” x 23” x 14” (width x height x depth). It contained the compressor and the clean/used water tanks linked to the handpieces and suction, as well as a movable tray (Fig. 1: Portable dental unit (commercial brand)). According to the manufacturer’s website, this unit weighs 28.5 kg and is priced starting from approximately CAD 8,000. The other two clinics used custom-made dental units. The owner of Clinic A had envisioned the design based on personal experience and collaborated with a technician to execute it. According to this dentist, the unit cost around CAD10,000. It consisted of two stackable cases: one case for the compressor and water tanks (Fig. 2: Compressor case in customized portable dental unit) and the other one was fitted with drawers for storing instruments (Fig. 3: Storage case in customized portable dental unit). The dimensions of the stacked cases were 13" x 51" x 16" (Fig. 4a,b: Custom-made portable dental unit). Clinic C had purchased two of the latter customized units because the dentist wanted to accelerate transitions between patients in LTCFs. While the dentist would be finishing up with one patient, the assistant would take the second dental unit and begin the set up in the next patient’s room. Meanwhile the dentist would disinfect the used unit before catching up with the assistant. During this research, the same dentist who designed the customized stackable units was finalizing a new design of a

compact unit for homes (Fig. 5: Compact custom-made portable unit for home visits). The new unit was lighter and easier to carry, the dentist explained:

The [smaller]unit is built with an electric motor with variable speed controlled by electric pedal, and a small compressor for air and water. No air reservoir is needed

Every morning, before heading out for the day, the dentist or dental assistant packed their instruments and equipment from the garage into their vehicles (Fig. 6: Vehicle with dental equipment for domiciliary visits). All three clinics typically transported: the dental unit, individual sterilized dental examination kits, other instruments and material (e.g. impression trays, extraction forceps, dental filling material) and disposables like gloves and bibs (Fig. 7: Instruments and disposable packed for domiciliary visits). The instruments and materials were packed into a rolled suitcase (Fig. 8: transporting equipment using rolled suitcases) and/or into the storage case of the customized dental unit. Sometimes a backpack was added for additional storage.

Domiciles. The three clinics had different profiles, clinic B primarily offered home visits, clinic C focused on LTCFs, and clinic A served a mix of homes and LTCFs with a focus on the latter. Some dentists expressed a preference for working in LTCFs and described them as more “efficient” due to the hospital-like set up and the support of nursing staff; the potential to see multiple patients in one trip; and avoidance of moving equipment in, out, and between homes. According to those dentists, the number of patients they visited per day ranged from 7 to 10. On the other hand, the dentist who focused on home-visits was able to see four to five patients per day:

The maximum I see is four patients (per day), *five I would be exhausted. I must reserve 1.5-2 hours per patient given the commute, set up, etc... So, if we calculate all that, the maximum number of patients I can have in my practice is 300. It's not a lot. I used to see up to 12 patients before (in a traditional dental office)* (Dentist, Clinic B)

Service Features

Main Actors: Roles, Attitudes, and Attributes. Roles of Service Providers. The history and organization of the clinics varied. In one clinic, the dentist started offering domiciliary services immediately after graduating from dental school and gradually grew his practice bringing associate dentists, dental assistants, and clinic managers into the team. While the owner and another experienced associate provided services independently, the dental assistants rotated among the other associates forming teams of two. The two full-time administrators (clinic manager and assistant-manager) managed the scheduling, billing, and coordination of appointments while remotely monitoring daily developments.

In the other two clinics, the dentists had made the shift to domiciliary dentistry after a few years of practicing in traditional clinics. They launched their services in teams of two, working closely with their dental assistants. One of them later hired a secretary who traveled with the dentist and the dental assistant in order to complete patients’ files on-site. This, according to the dentist, saved time and allowed them to see more patients per day.

Attitudes and Attributes of Service Providers. The dentists expressed different motivations for starting their mobile practice, their personal stories constituting a mix of altruism and self-interest. First, they described a desire to give and help others that was fueled by personal life events: one dentist was motivated by their work with geriatric patients before making the switch to mobile dentistry; another described having a “transformational” personal experience as a caregiver; and a third was inspired by a role model in the field. For these dentists driven by altruism, domiciliary dentistry was particularly appealing as it responded to the needs of people that they perceived as vulnerable and underserved. One dentist, for instance, highlighted the importance of helping seniors maintain their autonomy and reside in their homes as late as possible. Referring to the current COVID pandemic and its concentration in LTCFs, this dentist emphasized the importance of home-based domiciliary dentistry.

Besides altruism, some dentists described how mobile dentistry also fulfilled their own interests, mentioning the advantages of having flexible working hours and a profitable model of practice. One dentist, for instance, explained that the switch from a traditional to a mobile practice improved their work-family life balance and eliminated the high running-expenses of a fixed clinic.

I wanted a family and easier life, so it was easier knowing we don't have to work in the evening. If the baby is sick or something, it’s not a big structure to keep running. (Dentist, Clinic C)

The dentists and dental assistants shared some notable personality traits including patience, adaptability, and resilience that seemed essential for this type of practice. Patience was particularly needed when dentists were starting their mobile clinics. They described the process as a “big learning curve” due to the lack of resources for mobile clinics compared to traditional clinics (such as guidelines, equipment, and training). For this reason, they acknowledged, some dentists may give up quickly on the idea of providing domiciliary services because they may not find the support they need.

Dentists also needed to be patient and adaptable on a daily basis as they navigated through domiciliary settings and dealt with various challenges, such as poorly accessible buildings, uncooperative patients, or other external variables like bad weather and lack of parking space (more details on these issues in the following sections). The administrative dental staff also needed patience and good organizing skills as they coordinated the logistics, appointments, and payments with the patients or their caregivers, including family members or the LTCF staff. Adaptability and persistence were such prominent and somehow unusual qualities for dental professionals that one dentist concluded: “this type of practice is not for everyone!”. (Associate Dentist, Clinic A)

Our data also showed that the dentists and their staff were able to develop their skills over the years and that their type of practice even had positive impacts on their personal life. Acknowledging that working with a vulnerable population was emotionally demanding at first, the participants also explained they became more resilient with time and improved their ability to manage their emotions and handle difficult situations. Describing the transformational power of their practice, a dental assistant even described her work in domiciliary dentistry as “life-changing”:

We all will grow old and get to this stage, we will be like them. This made me re-evaluate my own life. I didn't want to be in a bad relationship…we need to be happy now and live in the moment (Dental assistant, Clinic C)

Patients and their Networks. The clinics provided domiciliary services to older adults and people with disabilities or debilitating health conditions who faced challenges in accessing traditional dental clinics. Home visits were also provided to patients with major depression or agoraphobia. When necessary, family members, LTCF staff, or caregivers were involved in different aspects of the visit such as organizing the appointment or supporting the patient during the visit. LTCFs staff and nurses, for instance, facilitated dental appointments through scheduling, providing access to patient's medical information, transferring the patient from wheelchair to bed or vice versa, and sometimes administering medication requested by the dentist prior to the visit.

Attitudes of Patients and Caregivers. Patients and their caregivers expressed gratitude towards the dentists for offering domiciliary on-site services. Having a mobile dentist was described by one caregiver as "marvelous! Just marvelous!". A grateful 79-year-old patient diagnosed with Parkinson's and arthritis described how quickly his physical condition deteriorated forcing him to switch from cane to walker to wheelchair over a short period of time:

I woke up one morning two years ago and was unable to walk. They took me to the hospital and from there to the nursing home. I had been very regular with my dental visits for over 20 years, so I was delighted to find [the mobile dentist]! *He is very professional. I feel comfortable with him and trust his opinions*

Furthermore, when asked what they valued the most, participants highlighted human qualities and competence of the dental team describing them as "kind" and "caring" and admiring their preparedness in terms of skills and equipment.

According to patients and caregivers, domiciliary dentistry eliminated the challenges they faced when seeking oral healthcare such as difficulties in "travelling" to a clinic; the physical barriers of inaccessible dental offices, and the lack of skills and negative attitudes of some dental professionals.

Getting to a dental clinic was one of the main reported challenges. According to one patient, getting to a dental clinic was "painful" because of old age, poor health condition, and fear of travelling. Additionally, unanticipated delays or no-shows of adapted transport may occur, leading to missed or cancelled appointments. Caregivers also described travelling as complicated, time consuming, and physically demanding for them too; since some caregivers were older adults themselves with varying physical abilities.

I took her in her wheelchair to the dentist…That was harder on me than her because I have a sore shoulder. I had to put her into the car and then the (wheel) *chair, and I'm not able to that on my own. I*

actually adapted but it is just more physically demanding…(and) *it's definitely a longer process"* (daughter of elderly patient)

Domiciliary dentistry also eliminated the challenge of accessing poorly adapted clinics and receiving quality dental care. One caregiver, for instance, highlighted the difficulties she used to experience when trying to maneuver her mother's wheelchair in the small rooms of the dental clinic and how overwhelming this task was. Another caregiver, the daughter of 94-year-old patient with Alzheimer's, recalled "[before finding the mobile dentists] I once thought about taking [my mother] to my dentist…he saw her and said *No, I can't!*". Finally, a bed-ridden patient deplored dentists' lack of competence and pointed out that it was hard to find "doctors who [were] specialized [in reference to her disability]"; she also believed that some dentists had negative attitudes and "[did] not want to treat elderly patients".

Interactions, Logistics and Treatment. Interaction between the Dental Team, Patients, and Others Involved. The interactions of the dentists in domiciliary dentistry could take various forms: with patients and their families; with LTCF nurses and staff; and with the other members of the dental team (both in-person and remotely). Communication had several layers that were more complex than in traditional clinical settings and sometimes created challenges. In terms of interactions with patients, it was common to come across patients with dementia or Alzheimer's leading to more complexed interaction. One dentist, for instance, explained that Alzheimer's was "particularly challenging" for the dental team, as the patient may not recognize the dentist, even after several encounters, making it difficult to establish communication and trust.

Also, it was often necessary for the dentists to involve family members or caregivers due to inability of some patients to consent to treatment. The legal representative or caregiver would give the approval to proceed with a treatment plan and guarantee payment. One dentist describes how he sometimes had to take intra-oral photographs as "evidence" of his work because family members may be skeptical or may question the dentist on what had been done.

Moreover, when patients resided in a LTCF, the dental team also communicated with the LTCFs nurses, attendants, and administrative staff to obtain information about the medical history and the list of medications or to give specific instructions (such as giving antibiotic medication pre/post dental treatment). The following Vignettes (created from our observation fieldnotes) illustrate examples of the particularities of communication in domiciliary dentistry.

Vignette 1: The dentist had a follow-up appointment with a 94-year-old patient with Alzheimer's who resided in a LTCF. From previous encounters, the dentist was aware of the patient's tendency for aggressive behavior (ex. biting). The patient's daughter booked the appointment directly with the mobile clinic's manager; the latter then called the residence staff to relay the dentist's instruction to give the patient a small dose of tranquilizer prior to the scheduled visit. The patient's daughter was not present at this appointment. Under medication, the patient was unable to engage verbally with the dentist and appeared in a light sleep. The dentist used non-verbal sensory stimulation to communicate certain commands (for example, applying slight pressure behind the corners of the lips to ask her to open the

mouth). After completing the appointment, the dentist called the patient's daughter to give her an update. He also wrote an update in the patient's file at the center and then sent an electronic update to his clinic's manager.

Vignette 2: Another patient in a LTCF was refusing to interact with the dental team. She turned her head away every time the dentist tried to approach and explain that the appointment was planned by her son. "My son did not tell me about this" the patient exclaimed repeatedly. The dentist tried to comfort her and asked if she would like to speak to her son to confirm that he had scheduled the appointment. The dentist used her own cell-phone and put the son on speaker to comfort his mother. The patient, relieved by hearing her son's voice asked him repeatedly to "stay" with her. The dentist placed the phone near the patient's bed and assured the patient that her son could stay with them for the entire session. Hearing the voice of her son comforted this person and allowed the dentist to perform the treatment (dental filling).

As shown in Vignette 1, some dentists resorted to prescribing small doses of tranquilizers to patients with aggressive tendencies. It is worth noting that one of the dentists in this study was not in favor of medicating patients and preferred them to remain aware of their presence and what they were doing. When attempts to gain patient's collaboration fail, she preferred to stop and to reschedule the appointment for a different day.

In terms of interactions within the dental team, the dentists communicated updates with their administrative staff in different ways. One dentist would send an electronic image of the patient's chart (in LTCFs, paper charts were retained in the patient's medical file) via "Dropbox" to his administrative staff immediately after an appointment. Another dentist used a laptop to complete files after every appointment while the remotely-based secretary had online access to the same software. Conversely, in the clinic where the secretary accompanied the team, the dentist would dictate the updates to the secretary who completed patients' electronic files during appointments.

Scheduling and Planning Visits. All administrative tasks (such as scheduling and billing) were performed on a dental practice management software, just like in conventional clinics. This said, these tasks were sometimes more complex and required more coordination and follow-up given: 1) the multiple levels of communication that were necessary; and 2) the need to consider the patients' locations in order to geographically pool visits, reduce traveling time, and maximize efficiency.

For example, a clinic manager described how they sometimes had to wait for family members/legal representatives to give consent in order to schedule visits. Occasionally, seeking those approvals took longer than anticipated, depending on how responsive the families were. Once consent was obtained, for patients residing in LTCFs, the clinic's manager had to contact the LTCF staff to inform them of the planned visit and to finalize scheduling. Then, a final confirmation call was usually done the day before the visits. Despite multiple confirmations, last minute changes occurred. For instance, one of the dentists explained that, one day, they drove over 30 minutes to a LTCF and discovered there that the patient had to be transferred to a hospital during the night.

An important consideration while scheduling appointments, according to several members of the dental team, was the pooling of visits by neighborhood or town, on any given day. A clinic manager highlighted how this was not an easy task, especially in the beginning of joining the mobile team. However, with experience, this team member explained, planning weekly and daily schedules became easier by learning to estimate length of visits and distance between locations, as well as considering other factors such rush-hour traffic. In the three clinics, the schedules were planned weeks in advance. The time allocated per visit varied between the three clinics. In LTCFs the duration ranged from 30minutes (Clinic C) to 60 minutes (Clinic A) per appointment. Home-visits, on the other hand, may require longer appointments of 1.5-2 hours (Clinic B) due to varying traveling and setup durations.

Subsequently, another logistics challenge that arose for mobile clinics was emergency appointments or urgent follow-ups. With carefully planned, area-specific schedules, the dental teams found it often difficult to “fit in” new appointments in random locations. One potential solution described by the dentists is to reserve a half or full day for emergency visits. However, given the high demand and low supply of domiciliary dentistry, they remained unsure about the most ideal approach and had not implemented anything particular in their clinics.

One dentist believed that the solution to increase availability of domiciliary dentistry would be the adoption of what they coined “proximity dentistry”. In this model, existing traditional clinics would offer a mix of fixed and mobile services within a one Kilometer radius of the clinic. When such a model is reproduced in different neighborhoods and locations, it would help with the issue of travel time for both dentists and patients, as well as increase the reach of mobile dentistry to those in need.

Accessing the Domiciles. Obstacles related to weather conditions and/or accessibility of domiciles sometimes complicated the process of domiciliary dentistry. Quebec’s winter weather conditions are sometimes harsh. Snow storms lead to reduced visibility for commuters and piled snow or icy sidewalks become a hazard for pedestrians. Such unfavorable weather sometimes complicated the drive and moving the equipment from the vehicle to the domiciles. Additionally, the type of domicile may further complicate access due to multiple stairs, lack of elevators, distance from parking to entrance, etc.

Both LTCFs and private homes had their unique advantages and disadvantages in terms of access. LTCFs typically offered: 1) designated parking spaces; 2) multiple patients in one location; 3) easy access to medical charts with detailed medical history and medication information; and 4) rooms equipped with electric beds and transfer-lifts (operated by the nurses), which facilitated positioning patients for treatment.

The disadvantages of LTCFs were mainly related to strict access protocols or dealing with staff. For example, during one of our observation rounds, the dental team had to wait at the reception for approximately 10 minutes to be granted access to a LTCF because the receptionist was not informed of the anticipated visit and had to make several calls before letting them in. In another LTCF, the dental team had to wait a couple of minutes at the door because the security guard was on break and they were not given the access code. Then, they had to make several stops inside the building to ask for directions to

the patient's room. Sometimes the staff seemed unhelpful or would just refer the team to another member of the staff. The dentists sympathized with the staff and pointed that they were probably "overworked" due to the centers being understaffed.

On the other hand, in private homes or apartments, accessibility also varied depending on: 1) physical factors such as the location, lack of parking, and/or the presence of stairs; and 2) adaptability of the dental team to the various social contexts of home visits. Dentists with strong social communication skills could more readily navigate different norms and cultures inside patients' homes. For some dentists this was considered an overwhelming and distracting task. Others, however, highlighted the value of such interaction for themselves and for the patients:

I am someone who loves to have contact with people, so my first appointment, before the pandemic, was to take a coffee, talk with my patient, to really understand the profile of my patient. It was my approach… They [the patients and their families] *are usually tired and stressed, we are there for them… a mobile dentist is way more than just that. So, if I can provide social support, moral support, and indirectly, we can create a network with the nurse, the CLSCs* [French acronym for the local community service centers] (Dentist, clinic B)

It is a gift to go to homes. We enter their intimate space. They trust us and include us in their social life. (Dental assistant, clinic C)

Patients need them [home visits], *there is a lot of demand. They are very appreciative, and the people are very nice… I got two cans of spaghetti last week!* (Dentist, clinic A)

Set up and Treatment. After entering a domicile, the dental teams began the process of positioning the patient, stationing the mobile dental unit, and then preparing the patient for examination and treatment. At LTCFs, the patients were usually positioned in their hospital beds. Electric hospital beds were convenient for the patients and ergonomically well suited for the dental team. In homes, patients were usually set up in their own wheelchairs; beds (conventional or electric); or in reclining arm chairs (such as the popular "Lazyboy"). Sometimes the dentist requested and assisted the patient to transfer to a more convenient spot (for example from wheelchair to bed).

To station the dental unit, the dental team located a power outlet close to where the patient is positioned in order to connect the unit. Also, depending on the nature of the visit, the dental team would locate the nearest sink (to rinse a denture, for example).

The last step in the set-up process was to prepare the patient by brushing the teeth and/or gums to remove any residue and facilitate examination. This step was considered essential as patients typically had poor oral hygiene practices. One dentist used a high-concentration chlorhexidine toothpaste as a prophylactic first-step for every patient. Another dentist only used a wet brush to clean the oral cavity and provided a high-concentration fluoride gel to patients on a need-basis.

The range of treatments performed by the dentists included: cleaning, dental fillings, abscess drainage, extractions, and some denture repair. According to the dentists, all dental treatments could potentially be performed by a mobile dentist, including endodontics and implants. However, given the prohibited use of mobile x-ray devices in the province of Quebec, they were sometimes reluctant to perform certain procedures. The main characteristics of the dental treatments were: 1) the focus on prevention and preservation as most patients could not tolerate lengthy restorative procedures; and 2) the use of dental materials that are easy to manipulate and have favorable properties such as Silver Diamine Fluoride (SDF) or glass ionomer. One dentist described SDF as an ideal material for arresting and preventing caries, that is also easy to apply and did not require any specialized equipment.

At the end of each session, the dentist or dental assistant thoroughly disinfected the mobile dental unit and stored away any used instruments in a covered container. At the end of the day, the dentist or the dental assistant returned the containers to the storage facility for sterilization.

Financial aspects. The dentists acknowledged concerns among dental professionals over the financial viability of domiciliary dentistry. However, they emphasized that with patience they were able to build a profitable service model. They argued that although financial gain may be slow at the beginning, mobile dentists who are just starting need to give it time. One dentist explained that it took a lot of adjustment when starting: “it [was] very difficult to move around [LTCFs] at first…when I first began with my assistant, I remember it would take us half an hour just to get from the parking to the room!”. “At the beginning it’s slow, but now it’s very good!” said another dentist referring to financial returns after less than two years in mobile practice. The three clinics set their fees in accordance with the provincial syndicate fee-guide (just like conventional clinics). Additionally, two of the clinics charged a fixed displacement fee per patient ($100 and $110, respectively). According to a dentist who did not charge the extra fee, they compensated travel costs by pooling patients in LTCFs to maximize the number of appointments per location.

One dentist believed that the prevailing concerns about poor remuneration for mobile dental services among dentists are rooted in the approach dental schools take in training dental professionals and confirm the persistent inequities in access to oral healthcare:

Even in a conventional clinic, treating geriatric patients or patients with disabilities is not money making! it requires more time, more appointments… but that’s not what we were taught in school. At school we learn to do crowns, fill cavities, but we don’t learn to treat the human!... I don’t have a choice [regarding the displacement fee], *if I don’t do it, it* [the service] *doesn’t pay back… A lot of people don’t take my services because it’s expensive, but what I charge is the least I can charge for my company to be running*

Discussion

We studied three cases of domiciliary dentistry in the province of Quebec, Canada. We described the main features of their set up including operationalization, feasibility, advantages, and limitations. We also examined the service features including attitudes, interactions, and financial aspects. Our case study

analysis and the following discussion points and recommendations could be transferred or adapted to other contexts of oral healthcare delivery.

Domiciliary Dentistry is Feasible

In terms of setting up a domiciliary dentistry service, the physical requirements can be readily arranged as instruments used in mobile dentistry are the same as those used in conventional clinical settings. In this study, the dentists invested in commercially available or customized portable dental units. The market offers several types of portable dental units and a quick internet-search yields multiple options at various prices ranges. Notably, despite the well-equipped dental units in the three clinics, the range of feasible procedures was limited by the prohibition of portable X-ray units in domiciliary settings in Quebec.

Dentists who are reluctant to invest in a portable unit may consider alternative lower-cost options such as rechargeable (battery-operated) hand pieces and portable suction (13, 14). Alternatively, dentists may want to explore this type of practice by starting with a simple selection of instruments to perform basic dental care before eventually building their mobile practice and adding more sophisticated equipment (5, 15).

In terms of logistics, Dentists can choose to serve patients in private homes and/or LTCFs, based on their capacity and preferences. A common challenge for our clinics was scheduling emergency appointments and urgent follow-ups. This challenge could be attributed to the high demand for domiciliary dentistry and low number of mobile dentists offering this service (16).

Domiciliary Dentistry is Profitable

We found domiciliary dentistry to be profitable for the dental professionals in several ways. From an operational perspective, domiciliary dentistry offers a flexible work environment (5), a change of scenery (13, 14), and may allow for more work-life balance. Secondly, from a service perspective, it can be a highly rewarding practice for dental professionals as they provide care to those unable to seek it themselves (15, 17) and often involves rich experiences that are meaningful and potentially transformative. Finally, from a financial perspective, despite the commonly cited concerns about poor remuneration (13, 18, 19); The clinics' owners confirmed that this model can eventually be profitable. They also used multiple strategies to augment income such as: 1) charging a displacement fee; 2) focusing on LTFCs where multiple patients can be seen in one visit; and 3) Increasing efficiency during and between visits by increasing the size of the dental team or purchasing a second dental unit for LTCFs visits. The literature also points towards concerns about the costs of setting up and buying the necessary equipment (5, 20), however, this was not a concern among the dentists in this study. They did not hesitate to invest in portable dental units because they believed in the potential and need for such a service, hence, justifying the initial costs.

Treating patients with various physical or cognititve disabilities indeed requires longer appointments and the time-in-transit between patients may sometimes be considered a loss of income-opportunities. This is

particularly amplified when a dentist practicing in a fixed clinic attempts to add-on domiciliary services. In this case, the running costs of a fixed clinic would be difficult to compensate for. Some solutions include hiring associates who would replace the mobile dentist in the fixed clinic; or applying the concept of “proximity dentistry” where dentists in different parts of the city would serve their proximal community both in the clinic and/or in domiciles, when necessary. Nonetheless, our mobile dentists highlighted the need to shift from prevailing treatment-focused attitudes within the dental profession towards a more holistic and person-centered approach in order to fight persisting inequities (14).

On the other hand, seniors may have financial insecurities due to loss of income and subsequently, loss of dental coverage from employment insurance. This situation, coupled with the lack of government coverage for dental services for adults in countries like Canada, further aggregates the financial barriers rendering dental services (including domiciliary dentistry) unattainable for a growing segment of the population.

Domiciliary Dentistry is Valued

Patients and caregivers expressed gratitude and appreciation for the clinics’ domiciliary services. They were especially grateful for finding a dentist who was willing to come to them and praised the dental teams’ kindness, patience and skills. Research has shown that dependent elderly and people with disabilities feel less anxious and become more involved in their dental care when it’s provided in a familiar environment (21, 15). Such services also reduce the burden on caregivers who would otherwise need to carefully move the patients, bring them to ta clinic, and manage unpredictable accessibility issues. Ultimately, domiciliary dentistry promotes equity and accessibility of comprehensive oral health care to those who may struggle to seek it themselves.

So, What Can Be Done to Promote Domiciliary Dental Services?

At the personal level, dentists who are interested in providing services for dependent elderly and people with disabilities could benefit from continuing education courses that would familiarize them with the specifics of caring for geriatric patients or patients with particular conditions such as Alzheimer’s, for example. At a professional level, authorities could develop policies that support the practice of domiciliary dentistry and, in contexts such as Quebec, Canada, permit the use of portable X-ray units to improve the scope of domiciliary dental procedures. Furthermore, on a structural level, dental schools could play a major part in shaping future dental professionals’ attitudes towards alternative models of dental practice through targeted training, community outreach programs, and interdisciplinary collaborations with other healthcare professionals. Finally, national healthcare systems could also play a significant role by developing and promoting oral healthcare strategies that would increase access to care for all member of society such as mandating oral healthcare services in LTCFs (22).

Conclusion

Domiciliary dentistry is a feasible and potentially profitable alternative model of dental practice that provides more equitable oral healthcare to a growing population of dependent elderly and people with disabilities. This study contributes to building evidence-based models of domiciliary dentistry. More research from different contexts can continue to examine alternative models of oral healthcare delivery such as domiciliary dentistry. Also, given the calls for curricular shifts in undergraduate dental programs towards more patient and society centered dentistry; future studies could assess the impact of educational intervention on new graduates' attitudes towards domiciliary dentistry.

Declarations

Ethics approval and consent to participate

Informed consent was obtained from all participants in this study. Ethical approval was obtained from the Institutional Review Board, McGill University (IRB Study Number A06-E50-18B)

Consent for publication

Pictures where taken with consent of participants

Availability of data and materials

The datasets generated and/or analysed during the current study are not publicly available due to potential to compromise anonymity of participants but are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

NM conducted the study, collected and analyzed data, and wrote the manuscript. JR contributed to the conceptualization and design of the study, and revision of the manuscript. CB conceptualized and designed the study and substantially revised the manuscript. All authors read and approved the final manuscript

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Figures

Figure 1

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