

Original Research

Home Dental Care to Homebound Older Adults in Primary Healthcare: A Mixed-Method Study

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Abstract

The study aimed to understand the provision of home dental care for homebound older adults within the context of primary healthcare. A mixed-methods, concurrent, parallel, and cross-sectional study was conducted. Quantitative data were collected from 123 homebound older adults through structured questionnaires and oral examinations and analyzed using descriptive and bivariate statistics. Qualitative data were collected through interviews with 37 homebound older adults and/or caregivers and eight primary healthcare dentists and analyzed using Bardin's content analysis. Data integration was conducted using a convergence-divergence matrix. Among the participants, 45.5% needed help with oral hygiene, 24.4% did not perform or receive daily oral hygiene, 17.9% had received home dental assistance provided by a dentist, and 32.5% reported difficulty accessing dental services. Daily



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oral hygiene was associated with sex, age, family income, unresolved oral health problems, and need for help with oral hygiene. The qualitative findings showed that homebound older adults relied on caregivers for daily care. At the same time, oral health was often not prioritized, inadequately supported, or limited by barriers in primary healthcare organizations. The integrated analysis showed convergence between frailty, functional dependence, caregiver reliance, and limited access to dental care. It also revealed a divergence between reported oral hygiene practices and poor clinical oral health. These findings indicate that home dental care for homebound older adults remains insufficiently integrated into primary healthcare. Structured domiciliary oral health protocols, caregiver guidance, periodic oral health assessment, and active participation of dental teams in home care are needed to improve comprehensive care for this vulnerable population.

Keywords

Frail older; oral health; home care; primary health care; homebound persons

1. Introduction

Homebound is a challenging condition characterized by the need for assistance with activities of daily living, life-space confinement, mobility, powerlessness, reduced endurance, and weakness [1]. Poor oral health among homebound older people can worsen existing health conditions, reduce quality of life, and increase the burden on caregivers and healthcare services. Adequate oral health care may be associated with better functional and nutritional status in this population and may reduce the risk of mortality and other adverse health-related outcomes in older adults [2].

Primary health care can expand access to health services [3] and improve health outcomes for homebound older people [4]. Integrating dental care into primary healthcare services can improve access to oral health services, particularly for vulnerable populations [5] such as homebound older adults. This integration can contribute to better health outcomes, more sustainable dental services, and more effective management of oral diseases [6].

However, the frequency of dental consultations decreases with age among older adults [7]. The reasons for the lack of regular dental consultations are multifactorial, including financial barriers, functional and cognitive impairment, and worsening general health [7]. Most studies exploring dentists' experiences in providing oral health care to older adults are surveys focused on long-term care institutions [8]. This highlights a gap in evidence on the provision of dental care to homebound people within a primary healthcare model of care.

In this context, we sought to understand the relationships among social, health, and oral health conditions and home dental care provision for homebound older adults in primary healthcare, integrating quantitative and qualitative data through a convergence-divergence analytical matrix. The quantitative data aimed to estimate the associations between sociodemographic, health, and oral health conditions and home dental care, defined as home dental assistance and daily oral hygiene. The qualitative approach aimed to analyze the perceptions of homebound older adults, caregivers, and primary healthcare dentists regarding home oral health care. By integrating both

datasets, this study provides a broader understanding of the factors involved in home dental care for homebound older adults in primary healthcare.

2. Method

2.1 Study Design

A mixed-methods, parallel, concurrent, cross-sectional study was conducted, with quantitative and qualitative data collected and analyzed as complementary components. The quantitative component followed the principles of the epidemiological method, and the qualitative component followed Bardin's Content Analysis technique [9]. The study was designed to integrate both datasets through a convergence-divergence analytical matrix.

2.2 Study Setting

The study was conducted in Florianópolis, the capital of Santa Catarina state, Southern Brazil. People aged 60 years or older correspond to 11.4% of the municipal population [10]. The population has access to primary healthcare services through the Brazilian universal public health system, the Sistema Único de Saúde (SUS), including free dental care. In this context, healthcare for homebound older adults is considered an attribute of primary healthcare teams. These teams include oral health professionals, such as dental surgeons and dental assistants, who are also responsible for providing home dental care.

2.3 Study Population

The study population comprised homebound individuals aged 60 years or older who were followed by primary healthcare teams. Homebound older adults were defined as individuals with physical, mental, or other disabilities that limited their ability to leave home or move independently [11].

2.4 Quantitative Sample Size and Recruitment

The quantitative sample size calculation was based on a municipal population estimate of 48,423 people aged 60 years or older and an estimated proportion of 4.9% of older adults who are bedridden [11]. Considering a homogeneous sample, a 5% sampling error, and a 95% confidence level, the required sample size was estimated at 223 homebound older adults.

A convenience quantitative sample was used because eligible participants had to be identified through primary healthcare teams responsible for following homebound older adults. To improve territorial coverage and reduce selection bias, recruitment was organized in two stages. In the first stage, 20 primary healthcare teams were drawn from the 120 teams in the municipality, with five teams selected from each of the four Health Districts. It was estimated that each team followed approximately 10 to 12 homebound older adults. In the second stage, the selected teams provided updated lists of homebound older adults under follow-up, including names, addresses, telephone numbers, and birth dates. These lists were sorted by birth date in a Microsoft Excel® spreadsheet.

The initial sampling frame was defined after the selected teams provided the lists of older adults. Considering the 20 lists provided and after applying the inclusion and exclusion criteria, 236

homebound older adults were identified as potentially eligible. Participants and/or caregivers were contacted by the research team in person or by telephone, and home visits were scheduled when participation was accepted. Older adults and/or caregivers who refused participation, were absent from home after three contact attempts, or had moved were considered losses. The participant selection process is summarized in Figure 1.

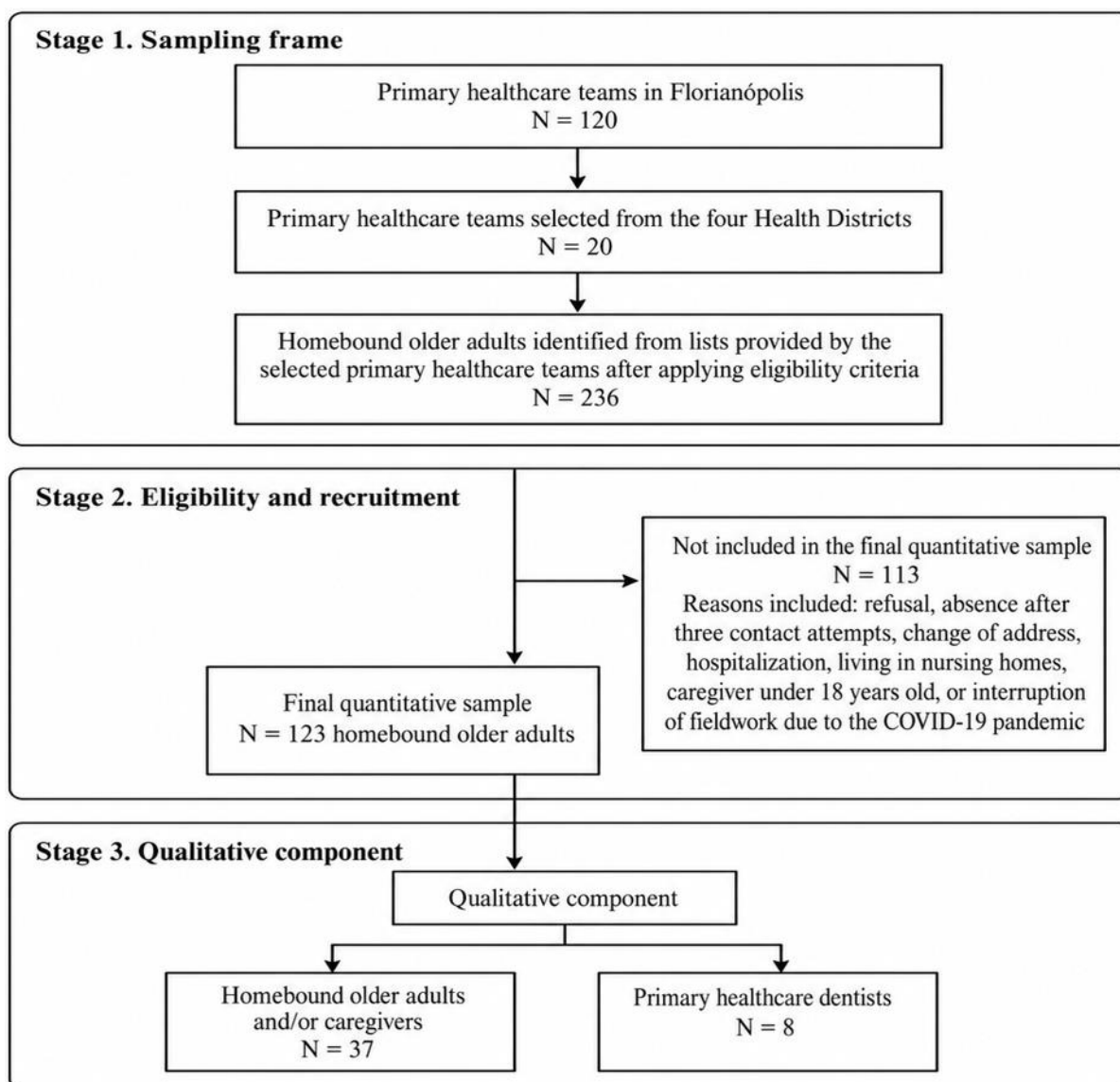


Figure 1 Flowchart of recruitment and composition of the quantitative and qualitative samples. Note: The group not included in the final quantitative sample (n = 113) comprises losses, exclusions, and interruptions in recruitment; detailed distribution by reason was not available.

Data collection with homebound older adults took place between September 2, 2019, and March 16, 2020. Fieldwork was interrupted on March 16, 2020, due to the COVID-19 pandemic lockdown, which prevented home visits. Therefore, the final quantitative sample included 123 homebound older adults. This smaller final sample was taken into account when interpreting the findings, especially regarding statistical power, exploratory associations, and generalisability.

2.5 Qualitative Sample

The qualitative sample consisted of homebound older adults and their caregivers. One in three participants in the quantitative sampling plan was invited to the qualitative component, resulting in 37 older adults and/or their respective caregivers. In addition, eight primary healthcare dentists were intentionally selected because they were actively working in the primary healthcare network and could provide information on the organization and provision of oral healthcare for homebound older adults.

2.6 Inclusion and Exclusion Criteria

The inclusion criteria for older adults were being homebound, aged 60 years or older, and having physical and/or mental conditions that allowed participation in the study. When older adults were unable to complete the questionnaire, their respective caregivers were invited to participate as respondents, provided they were 18 years of age older. For dentists, the inclusion criterion was active employment in primary healthcare during data collection.

Older adults absent from home after three contact attempts, those living in nursing homes, hospitalized individuals, and cases in which the caregiver was under 18 years old were excluded.

2.7 Fieldwork Training and Pilot Study

Four data collection teams were formed, each composed of a dentist and a dental student acting as an assistant. All teams completed a four-hour training course to standardize research procedures, instruments, fieldwork flow, and clinical criteria. Before the main data collection, a pilot study was conducted with older adults outside the sampling process to test the instruments and organize the fieldwork.

2.8 Quantitative Data Collection

Quantitative data were collected at the participants' homes using a structured questionnaire answered by the older adult or, when necessary, by the caregiver. Sociodemographic variables included sex, age, family income, schooling, presence of a caregiver, and time spent homebound. Sex was categorized as male or female. Age was collected in years and categorized as 60 to 69, 70 to 79, 80 to 89, and 90 years or older. Family income was collected in Brazilian Reais and categorized as minimum wage, based on the average total income of household residents over the previous three months. Schooling was measured as the number of completed years at school. The presence of a caregiver was categorized as yes or no. Homebound time was measured in years at the time of data collection; when shorter than 11 months, it was rounded up to one year.

Health conditions were assessed using the Kihon Check List (KCL), a multidimensional assessment tool composed of 25 dichotomous items (yes/no). The KCL assesses physical strength, nutrition, eating, socialization, memory, mood, and lifestyle domains and has been validated for use among older adults in Brazil [12].

As most homebound older adults were bedridden, the item related to weight and height measurement for estimating Body Mass Index was replaced by calf circumference measurement. The overall KCL score and the score for each domain were evaluated [13] as follows: Lifestyle, items 1 to 20, with 10 points or more indicating frailty; Physical strength, items 6 to 10, with three points

or more indicating low physical strength; Nutrition, items 11 and 12, with two points indicating low nutritional status; Eating, items 13 to 15, with two points or more suggesting compromised eating; Socialization, items 16 and 17, with a negative answer to question 16 or 17 indicating home restriction; Memory, items 18 to 20, with one point or more suggesting low cognitive function; and Mood, items 21 to 25, with two points or more indicating risk of depression.

2.9 Oral Health Examination and Home Dental Care Variables

Oral health status was assessed through a clinical oral examination performed at home by a dentist. The examination was conducted using a wooden spatula and a mobile phone flashlight, reflecting the operational conditions of domiciliary fieldwork. Bedridden participants were interviewed and examined in bed. Participants who were not bedridden were interviewed and examined while sitting on a chair or sofa.

The oral health variables were presence of visible plaque on teeth and dentures (yes/no), number of natural teeth, number of cavitated caries lesions, number of residual roots, presence of fistula or exudate (yes/no), presence of tooth mobility (yes/no), and presence of oral mucosa lesions (yes/no). Home dental care variables included whether the participant had received home dental assistance provided by a dentist (yes/no), whether the participant performed or received daily oral hygiene (yes/no), whether the participant needed help cleaning the mouth (yes/no), and whether the participant reported difficulty accessing dental services (yes/no).

All quantitative data were recorded by the assistant student using a Google Forms® form specifically designed for the study.

2.10 Qualitative Data Collection

Qualitative data from homebound older adults and/or caregivers were collected through individual interviews using a semi-structured script. The script was tailored to homebound participants and adapted for caregivers. It was designed to deepen the understanding of home oral healthcare, care routines, and barriers to access.

The interview questions addressed: (a) general aspects of health and oral care routines, including access to home care services; and (b) the influence of being homebound on health, oral healthcare, and access to health services. Interviews were conducted by a dentist and audio recorded using a mobile phone.

Qualitative data from primary healthcare dentists were collected online in November 2020 using an open-ended Google Forms® questionnaire. Dentists were invited in person or by email. After acceptance, a questionnaire link was emailed. Participants answered one written question about factors influencing oral healthcare provision for homebound older adults, considering three aspects: (a) the health status of homebound older adults; (b) characteristics of primary healthcare dentists; and (c) health service structure and organization.

2.11 Quantitative Data Analysis

Quantitative data were analyzed using IBM SPSS® software, version 23. Descriptive statistics were used to characterize sociodemographic, health, oral health, and home dental care variables. Categorical variables were presented as absolute and relative frequencies.

Bivariate analyses were performed using the chi-square test or Fisher's exact test, as appropriate. The outcomes of interest were receiving home dental assistance provided by a dentist (yes/no) and performing or receiving daily oral hygiene (yes/no). These outcomes were analyzed according to sociodemographic variables, KCL domains, oral health status, and home care variables. A p-value lower than 0.05 was considered statistically significant.

Multivariable analysis was considered but not performed because the final sample was smaller than initially estimated and some outcome categories had sparse distributions, particularly home dental assistance. Therefore, the quantitative findings were interpreted as exploratory and were integrated with the qualitative findings to support a broader interpretation of home dental care provision.

2.12 Qualitative Data Analysis

Audio-recorded interviews were transcribed verbatim by one researcher using a Microsoft® text editor. Written answers provided by primary healthcare dentists were also organized for analysis. Qualitative data were analyzed using NVivo11® software (QSR International).

The qualitative data were analyzed according to Bardin's [9] proposal in three stages: pre-analysis; exploration of the material; and treatment of results, inference, and interpretation. The analysis sought to identify meanings related to homeboundness, dependence, caregiver participation, oral care routines, access to dental care, and the organization of primary healthcare services.

2.13 Mixed-Methods Integration

Data integration was conducted by constructing a matrix that displayed and compared quantitative and qualitative findings. The matrix was used to identify convergence, divergence, and expansion between datasets. Convergence indicated agreement between quantitative and qualitative results. Divergence indicated tension or inconsistency between the datasets. Expansion indicated that one dataset broadened or helped explain the interpretation of the other.

This integration supported the synthesis of the interpretative process and helped explain how social, health, oral health, caregiving, and service-related factors influenced home dental care for homebound older adults [14, 15].

2.14 Ethical Aspects

This study was approved by the institutional human research ethics committee (CEPSH/UFSC, opinion number 3.168.868). An informed consent form was provided to all participants, and consent was obtained by signature on paper or electronically.

3. Results

A total of 123 homebound older adults from Florianópolis participated in the quantitative component of the study. Their sociodemographic characteristics are presented in Table 1. Most participants were women (62.6%), aged between 70 and 79 years (34.9%) or 80 and 89 years (31.7%), had one to four years of schooling (61.0%), had a family income of one to three minimum wages per month (70.7%), had been homebound for one to four years (52.0%), and had a caregiver (87.0%).

Table 1 Sociodemographic characteristics of homebound older adults (n = 123). Florianópolis, SC, Brazil, 2019/2020.

Variable	Category	n	%
Sex	Male	46	37.4
	Female	77	62.6
Age group	60 to 69 years	13	10.6
	70 to 79 years	43	34.9
	80 to 89 years	39	31.7
	90 years or older	28	22.8
Schooling	1-4 years	75	61.0
	5 or more years	48	39.0
Homebound time	1-4 years	64	52.0
	5 or more years	59	48.0
Family income ^a	1-3 MW/month	87	70.7
	>3 MW/month	29	23.6
	No income	7	5.7
Presence of a caregiver	No	16	13.0
	Yes	107	87.0

Note: ^aBrazilian minimum wage (MW) was R\$998.00, equivalent to US\$249.50, in 2019.

Oral health status and home dental care characteristics are presented in Table 2. Visible biofilm was observed in 69.9% of participants, and 56.1% were edentulous. Among dentate participants, 57.4% had cavitated caries lesions, 51.9% had at least one residual root, 20.4% had tooth mobility, and 1.9% had fistula or exudate. Oral mucosal lesions were observed in 8.9% of the total sample.

Table 2 Oral health status and home dental care among homebound older adults (n = 123). Florianópolis, SC, Brazil, 2019/2020.

Variable	Category	n	%
Visible biofilm	No	37	30.1
	Yes	86	69.9
Natural teeth	0	69	56.1
	1-8	28	22.8
	9 or more	26	21.1
Cavitated caries lesions ^a	No	23	42.6
	Yes	31	57.4
Residual roots ^a	0	26	48.1
	1	19	35.2
	2 or more	9	16.7
Fistula/exudate ^a	No	53	98.1
	Yes	1	1.9
Tooth mobility ^a	No	43	79.6
	Yes	11	20.4
Oral mucosal lesions	No	112	91.1
	Yes	11	8.9
Performs/receives daily oral hygiene	No	30	24.4
	Yes	93	75.6
Needs help with oral hygiene	No	67	54.5
	Yes	56	45.5
Difficulty accessing dental services	No	83	67.5
	Yes	40	32.5
Received home dental assistance provided by a dentist	No	101	82.1
	Yes	22	17.9

Note: ^aCalculated among dentate participants (n = 54).

Regarding oral healthcare, Table 2 shows that 75.6% of participants performed or received daily oral hygiene, while 24.4% did not. Almost half of the participants (45.5%) needed help with oral hygiene. Difficulty accessing dental services was reported by 32.5% of participants, and 17.9% had received home dental assistance provided by a dentist.

The bivariate analysis of sociodemographic characteristics, oral health status, and oral healthcare variables, stratified by home dental assistance and daily oral hygiene is presented in Table 3. No statistically significant associations were observed between home dental assistance and the analyzed variables. However, unresolved oral health problems showed borderline statistical significance in relation to home dental assistance ($p = 0.053$).

Table 3 Bivariate associations between sociodemographic characteristics, oral health status, oral healthcare variables, home dental assistance, and daily oral hygiene among homebound older adults (n = 123). Florianópolis, Brazil, 2019/2020.

Variable	Category	Home dental assistance Yes n (%)	Home dental assistance No n (%)	p-value	Daily oral hygiene Yes n (%)	Daily oral hygiene No n (%)	p-value
Sex	Male	8 (36.4)	38 (37.6)	0.912	28 (30.1)	18 (60.0)	0.003
	Female	14 (63.6)	63 (62.4)		65 (69.9)	12 (40.0)	
Age group	60 to 69 years	1 (4.5)	12 (11.9)	0.655	4 (4.3)	9 (30.0)	<0.001
	70 to 79 years	9 (40.9)	34 (33.7)		30 (32.3)	13 (43.3)	
	80 to 89 years	8 (36.4)	31 (30.7)		34 (36.6)	5 (16.7)	
	90 years or older	4 (18.2)	24 (23.8)		25 (26.9)	3 (10.0)	
Schooling	1-4 years	11 (50.0)	64 (63.4)	0.244	57 (61.3)	18 (60.0)	0.900
	5 or more years	11 (50.0)	37 (36.6)		36 (38.7)	12 (40.0)	
Family income ^a	1-3 MW/month	15 (68.2)	72 (71.3)	0.313	59 (63.4)	28 (93.3)	0.007
	>3 MW/month	7 (31.8)	22 (21.8)		27 (29.0)	2 (6.7)	
	No income	0 (0.0)	7 (6.9)		7 (7.5)	0 (0.0)	
Homebound time	1-4 years	11 (50.0)	53 (52.5)	0.833	52 (55.9)	12 (40.0)	0.129
	5 or more years	11 (50.0)	48 (47.5)		41 (44.1)	18 (60.0)	
Presence of caregiver	No	2 (9.1)	14 (13.9)	0.547	14 (15.1)	2 (6.7)	0.235
	Yes	20 (90.9)	87 (86.1)		79 (84.9)	28 (93.3)	
Edentulism	Yes	10 (45.5)	59 (58.4)	0.267	55 (59.1)	14 (46.7)	0.231
	No	12 (54.5)	42 (41.6)		38 (40.9)	16 (53.3)	
Cavitated caries lesions ^b	No	3 (25.0)	20 (47.6)	0.171	19 (50.0)	4 (25.0)	0.096
	Yes	9 (75.0)	22 (52.4)		19 (50.0)	12 (75.0)	
Number of natural teeth	0	10 (45.5)	59 (58.4)	0.533	55 (59.1)	14 (46.7)	0.442
	1-8	6 (27.3)	22 (21.8)		19 (20.4)	9 (30.0)	
	9 or more	6 (27.3)	20 (19.8)		19 (20.4)	7 (23.3)	

Residual roots ^b	None	10 (83.3)	21 (44.7)	0.065	24 (58.5)	7 (38.9)	0.092
	1	2 (16.7)	17 (36.1)		13 (31.7)	6 (33.3)	
	2 or more	0 (0.0)	9 (19.1)		4 (9.8)	5 (27.8)	
Tooth mobility ^c	No	20 (90.9)	92 (91.1)	0.979	87 (93.5)	25 (83.3)	0.088
	Yes	2 (9.1)	9 (8.9)		6 (6.5)	5 (16.7)	
Visible biofilm	No	7 (31.8)	30 (29.7)	0.845	30 (32.3)	7 (23.3)	0.354
	Yes	15 (68.2)	71 (70.3)		63 (67.7)	23 (76.7)	
Oral mucosal lesions	No	19 (86.4)	93 (92.1)	0.395	85 (91.4)	27 (90.0)	0.816
	Yes	3 (13.6)	8 (7.9)		8 (8.6)	3 (10.0)	
Fistula/exudate	No	22 (100.0)	100 (99.0)	-	92 (98.9)	30 (100.0)	-
	Yes	0 (0.0)	1 (1.0)		1 (1.1)	0 (0.0)	
Unresolved oral health problems	No	11 (50.0)	72 (71.3)	0.053	70 (75.3)	13 (43.3)	0.001
	Yes	11 (50.0)	29 (28.7)		23 (24.7)	17 (56.7)	
Need for help with oral hygiene	No	13 (59.1)	54 (53.5)	0.631	59 (63.4)	8 (26.7)	<0.001
	Yes	9 (40.9)	47 (46.5)		34 (36.6)	22 (73.3)	

Note: ^aBrazilian minimum wage (MW) was R\$998.00, equivalent to US\$249.50, in 2019. ^bCalculated among dentate participants and valid responses.

^cTooth mobility was analyzed in the total sample, with edentulous participants classified as having no tooth mobility. Percentages were calculated within each outcome category. Associations were assessed using the chi-square test or Fisher's exact test, as appropriate.

Performing or receiving daily oral hygiene was associated with sex ($p = 0.003$), age group ($p < 0.001$), family income ($p = 0.007$), unresolved oral health problems ($p = 0.001$), and need for help with oral hygiene ($p < 0.001$), as shown in Table 3. These findings should be interpreted as exploratory, considering the bivariate design of the analysis and the absence of multivariable adjustment.

The Kihon Checklist results are presented in Table 4 and indicate a high burden of functional and health-related limitations among homebound older adults. Most participants did not walk for more than 15 minutes (86.2%), did not leave the house more than once a week (76.4%), had gone out less often in the previous year (61.0%), had suffered at least one fall in the previous year (52.8%), and reported discomfort due to dry mouth (50.4%). The prevalence of frailty was 89.4%. The most frequently impaired KCL domains were physical strength (95.1%), mood (73.2%), socialization (69.9%), and memory (65.9%).

Table 4 Kihon Check List findings among homebound older adults ($n = 123$). Florianópolis, SC, Brazil, 2019/2020.

KCL item/domain	n	%
Does not walk for more than 15 minutes	106	86.2
Does not leave the house more than once a week	94	76.4
Has gone out less often in the previous year	75	61.0
Had at least one fall in the previous year	65	52.8
Discomfort due to dry mouth	62	50.4
Frailty	110	89.4
Low physical strength	117	95.1
Risk of depression	90	73.2
Limited socialization	86	69.9
Low cognitive function	81	65.9

Note: KCL: Kihon Check List. Percentages were calculated using the total sample ($n = 123$).

The qualitative analysis identified three main categories: the context of older adults at home, home care for older adults, and oral care for homebound older adults in primary healthcare. These qualitative findings were integrated with the quantitative results in Table 5. The first category, the context of older adults at home, included social, economic, emotional, and health-related aspects affecting this population. Functional dependence, mobility restrictions, financial limitations, fear of leaving home, emotional vulnerability, and caregiver dependence emerged as central aspects of daily life. These conditions affected autonomy, access to healthcare services, and the ability to maintain oral health routines.

Table 5 Integrated matrix of quantitative and qualitative findings on living conditions, oral health, and home dental care among homebound older adults. Florianópolis, Brazil, 2019/2020.

Integrated theme	Quantitative findings	Qualitative findings	Type of integration	Interpretation
Functional dependence and caregiver support	Frailty: 89.4%; limitations in leaving home: 69.9%; cannot use the bus without help: 93.5%; does not shop without help: 97.6%; does not manage bank account: 88.6%; does not climb stairs without support: 87.8%.	Participants reported total or temporary dependence on daily activities. "We take care of everything like this. All the food, medication. Cleaning... everything a person needs here. We take them for walks. They exercise at home. They get the sunlight because of the vitamin D." OA1	Convergence	Quantitative and qualitative findings indicate that most homebound older adults are frail, dependent, and require daily support.
Mobility limitations and accessibility barriers	Limitations in leaving home: 69.9%; compromised physical strength: 95.1%; does not climb stairs without support: 87.8%; went out less often in the previous year: 61.0%.	Participants reported difficulty leaving home due to stairs, wheelchair use, fear, and mobility barriers. "Walking with wheelchairs is impossible. It's horrible." OA1; "I feel bad. I want to go out, but looking at the stairs puts me off." OA17	Convergence/ expansion	Qualitative findings explain how physical limitations become practical barriers to accessing health and dental services.
Fear of leaving home and emotional vulnerability	Risk of depression: 73.2%; low cognitive function: 65.9%; dissatisfaction with daily life in the previous two weeks: 51.2%; does not talk to family or friends: 17.9%.	Participants reported fear of leaving home and emotional suffering related to dependence, isolation, or loss of loved ones. "I'm afraid to go out because I might fall... and at home I always do my own little things." OA13	Expansion	Qualitative findings expand the interpretation of KCL domains by showing how emotional vulnerability affects autonomy and care-seeking.

Loss of loved ones and reduced self-care	Risk of depression: 73.2%; low cognitive function: 65.9%; dissatisfaction with daily life: 51.2%.	Participants reported loss of loved ones and emotional decline. "You know that I used to care very well for my health, but after my wife died everything went downhill... You know, self-esteem. Making food went downhill." OA4	Expansion	Loss, family abandonment, and lack of affection may intensify dependence and impair self-care.
Reported oral care versus clinical oral health condition	Performs/receives daily oral hygiene: 75.6%; visible biofilm: 69.9%; edentulism: 56.1%; cavitated caries lesions among dentate participants: 57.4%; difficulty accessing dental services: 32.5%; no home dental assistance: 82.1%.	Participants reported oral care routines, but also a lack of guidance. "I brush his teeth. He has breakfast and lunch. Then, after lunch, I wait for him to eat some fruit, something. Then I go and brush." OA11; "Apart from brushing, we don't do anything. We don't receive any guidance in this regard." OA22	Divergence/expansion	The existence of an oral hygiene routine did not necessarily indicate adequate oral care or professional guidance.
Caregiver burden and low priority of oral health	Presence of caregiver: 87.0%; need for help with oral hygiene: 45.5%; frailty: 89.4%; low cognitive function: 65.9%.	Dentists reported that oral health depends on caregivers, who also perform several other daily tasks. "Older adults without autonomy, with pathologies such as dementia, severe stroke sequelae, among others... Their oral health depends exclusively on their caregivers." D5; "Caregivers/family members not only care for the older adult, but also do household chores." D2	Convergence/expansion	Oral care is influenced by caregiver availability, workload, knowledge, and prioritization of oral health within home care.

Organization of home dental care in primary healthcare	Received home dental assistance from a dentist: 17.9%; difficulty accessing dental services: 32.5%; unresolved oral health problems related to daily oral hygiene: $p = 0.001$.	Participants and dentists reported barriers related to service organization, resources, planning, and access to dental care.	Expansion	The provision of home dental care depends not only on individual need but also on the organization of oral health within primary healthcare.
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Note: OA: older adult; D: dentist.

The second category, home care for older adults, described the practices, perceptions, and challenges experienced by older adults and caregivers in the home environment. General care was strongly dependent on family members and caregivers. Oral care was often reported as part of daily routines, but it was not always prioritized or supervised by a professional. Caregivers frequently accumulated several responsibilities, including feeding, medication management, hygiene, mobility support, and household tasks, which contributed to oral health being neglected or treated as a secondary need.

The third category, oral care for homebound older adults in primary healthcare, reflected the organization and limitations of home-based oral healthcare. Participants and dentists reported barriers related to mobility, access to dental services, limited resources, inadequate planning, and limited incorporation of oral health into domiciliary primary healthcare. Dependence on caregivers, limited caregiver knowledge, and socioeconomic constraints contributed to inadequate or insufficient oral care.

The integration of quantitative and qualitative findings is presented in Table 5. The integrated analysis showed convergence between the high prevalence of frailty, functional limitations, caregiver dependence, and the qualitative reports of dependence in daily activities. Qualitative findings expanded the quantitative results by showing how caregiver burden, fear of leaving home, and limited access to services influenced oral care routines.

As shown in Table 5, the integration also revealed a divergence between reported oral hygiene practices and clinical oral health conditions. Although many participants reported performing or receiving daily oral hygiene, clinical examination showed a high prevalence of visible biofilm, edentulism, and cavitated caries lesions among dentate participants, and a need for oral health support. This suggests that having an oral hygiene routine did not necessarily indicate adequate oral care or sufficient professional guidance.

Overall, the integration presented in Table 5 indicated that home dental care for homebound older adults is influenced by functional dependence, caregiver availability, socioeconomic vulnerability, oral health needs, and limitations in the organization of domiciliary dental care within primary healthcare.

4. Discussion

Our findings corroborate previous studies highlighting the vulnerability of homebound older people. This group faces several challenges, including frailty, risk of depression, low cognitive function, limited socialization, compromised oral health, and restricted access to dental services through primary healthcare [16, 17].

Most homebound older adults in this study were women aged 70 - 79 years, with low levels of schooling and income of up to 3 minimum wages. Previous studies also showed a predominance of women with low income and schooling among homebound older adults [18]. However, a more recent study found a higher prevalence of this condition among men, suggesting regional or methodological variations [11].

Oral health problems were frequent among homebound older adults, including edentulism, untreated caries, residual roots, visible biofilm, dry mouth, and oral mucosal lesions. These conditions may contribute to functional limitations and indicate the need for dental care. Previous studies reported similar findings, with high prevalence of tooth loss and dental caries among older adults [19, 20]. This scenario reflects an oral healthcare model still centered on curative practices, aggravated by social determinants such as low income, low schooling, and limited access to health services [21].

In the bivariate analysis, performing or receiving daily oral hygiene was associated with sex, age, family income, unresolved oral health problems, and need for help with oral hygiene. These findings suggest that demographic, socioeconomic, and care-related factors are involved in maintaining oral hygiene among homebound older adults [22, 23]. Income may influence access to dental services and oral hygiene supplies, and the ability to maintain daily oral care.

The findings highlight the interaction between social determinants and oral health practices. The association between income and daily oral hygiene is consistent with evidence showing that socioeconomic disparities influence access to dental services and adherence to basic oral care, such as toothbrushing [23]. Among homebound older adults, low income may restrict access to oral hygiene supplies and reduce autonomy in seeking care, reinforcing cycles of oral neglect [21, 24]. Dependence on caregivers may intensify this situation, especially when oral hygiene competes with other daily care demands. The qualitative findings showed that oral health was often not prioritized in home care and that caregivers frequently lacked specific guidance on oral hygiene. This indicates gaps in integrating oral health education into home care and primary healthcare services [6, 8].

Unresolved oral health problems may be related to physical limitations, dependence on caregivers, difficulty accessing dental services, low priority given to oral health, lack of knowledge about oral hygiene, and socioeconomic barriers [24]. They may also reflect limited coverage and accountability on the part of dental teams providing care to homebound patients. This reinforces the need to strengthen dentistry's role within primary healthcare and to apply equity principles for populations with greater barriers to accessing services.

A substantial proportion of homebound older adults needed help with oral hygiene, reported difficulty accessing dental services, and had not received dental assistance at home from a dentist. These findings suggest that oral health needs remain insufficiently addressed in this population. Older adults with oral health problems may face additional barriers to seeking treatment outside the home, especially when frailty, mobility limitations, transportation difficulties, and caregiver dependence are present.

Fear of leaving home was common among the older adults in this study, especially among the frailest, increasing dependence on caregivers and restricting access to healthcare services. Fear of going out has been associated with risk of depression, fear of falling, reduced frequency of going out, need for help, and strong dependence on care [25]. These factors may reduce confidence in daily activities, limit socialization, and increase frailty [16, 26].

The integration of qualitative and quantitative findings showed that risk of depression, mood changes, and impairment in daily activities were related to social isolation, dependence, and reduced autonomy. These findings reinforce the importance of adequate diagnosis, social support networks, and comprehensive care strategies to improve the quality of life of homebound older adults [17, 27].

The mixed-methods integration also revealed relationships among oral care, general health, frailty, and dependence. Quantitative data showed a high prevalence of frailty, functional limitations, poor oral health indicators, and limited home dental assistance. Qualitative data helped explain these results by showing how dependence on caregivers, caregiver burden, fear of leaving home, lack of guidance, and limited service organization affect oral care. Thus, oral health problems in this population should not be interpreted only as individual conditions, but as the result of social, functional, caregiving, and service-related barriers.

One important finding was the divergence between reported oral hygiene and clinical oral health conditions. Although many participants reported performing or receiving daily oral hygiene, clinical examination showed a high prevalence of visible biofilm, edentulism, and cavitated caries lesions among dentate participants, and a need for oral health support. This suggests that having an oral hygiene routine does not necessarily mean oral care is adequate, technically effective, or supported by professional guidance.

Based on our findings, primary healthcare services should implement structured domiciliary oral health protocols. These protocols should include periodic oral health risk screening, assessment of oral hygiene and denture hygiene, identification of urgent needs, and referral pathways for pain, infection, residual roots, oral mucosal lesions, poorly adapted dentures, and feeding difficulties related to oral conditions. Caregiver and family training should also be incorporated into home care routines, including guidance on toothbrushing in dependent older adults, denture hygiene, recognition of warning signs, management of dry mouth, and when to seek dental care [17].

Many older adults who depend on home care services do not use oral healthcare services, indicating failures in the current care system [28]. Integrating oral care with general health management is a key strategy to address this gap. This model recognizes the interdependence between oral and general health while increasing the visibility of oral healthcare needs among older adults, caregivers, and health professionals [29]. Care solutions should be adapted to the changing needs of older adults, prioritizing quality of life and autonomy [30].

Recent studies emphasize that frailty, functional dependence, and socioeconomic determinants, such as low income and low education, are important barriers to adequate oral hygiene and access to specialized services [31, 32]. Our integrated findings reinforce the notion that reliance on untrained or overburdened caregivers may contribute to oral neglect, oral morbidity, and reduced quality of life, a pattern also observed in international home care models [33, 34]. Interdisciplinary guidelines should include caregiver training, comprehensive geriatric assessment, and the integration of dental professionals into home healthcare teams [32, 33].

Intersectoral actions to reduce inequalities in access to basic oral hygiene supplies, combined with health education adapted to cognitive and functional limitations, are essential to reduce structural barriers.

This study has limitations. First, the use of convenience sampling and sample attrition may have introduced selection bias. Second, the initially estimated sample size was not reached because home visits were interrupted by the COVID-19 pandemic. This may have reduced statistical power, increased the possibility of type II error, and limited the generalisability of the findings. Therefore, the bivariate associations should be interpreted as exploratory. Third, the cross-sectional design does not allow causal inference. Fourth, oral examinations were performed under domiciliary conditions using simplified resources, including a wooden spatula and a mobile phone flashlight. Although data collection teams received standardized training and a pilot study was conducted, formal interexaminer agreement was not assessed. Some oral conditions may therefore have been underestimated or misclassified. Fifth, caregiver involvement was central to oral hygiene, but the study did not include a structured assessment of caregiver burden, oral health literacy, or caregiving skills. This limited a more detailed understanding of how caregiver-related factors influence daily oral care and access to dental services.

Future studies should explore strategies to improve oral healthcare for homebound older adults, including teledentistry and digital health. In public health services, teledentistry has been described as a tool for professional education and training, oral health surveillance, remote patient care, and interprofessional communication [35]. In the context of this study, teledentistry should not replace face-to-face domiciliary dental care when clinical intervention is required. It may be useful as a complementary strategy for remote triage, caregiver guidance, follow-up, prioritization of home visits, and communication among dental teams, other primary healthcare professionals, caregivers, and older adults. In primary healthcare, teledentistry can contribute to oral health literacy, reduce waiting times, support care coordination, and promote oral health equity [35].

The research agenda should prioritize multidisciplinary, longitudinal studies of oral healthcare practices for homebound older adults. Future research should evaluate the long-term effects of homeboundness on oral health, the effectiveness of domiciliary oral health protocols, the impact of caregiver training, and the contribution of teledentistry-supported follow-up. Such evidence may inform clinical guidelines, strengthen primary healthcare systems, and improve quality-of-life indicators in public health services.

5. Conclusion

Homebound older adults in this study were characterized by socioeconomic vulnerability, frailty, low physical strength, limited socialization, risk of depression, low cognitive function, and poor oral health conditions requiring professional attention. Despite these needs, access to home dental assistance through primary healthcare was limited, and daily oral care often depended on caregivers who may be overburdened and insufficiently supported. The findings indicate that home dental care for homebound older adults should be fully integrated into primary healthcare. This integration should include structured domiciliary oral health protocols, periodic oral health assessment, caregiver guidance, health promotion, disease prevention, and clear referral pathways for clinical intervention. Strengthening oral healthcare throughout the life course is also necessary to reduce the accumulation of untreated dental needs in older age.

Comprehensive care for homebound older adults requires recognizing oral health as part of general health, functional capacity, autonomy, and quality of life. Public health services should therefore ensure that dental teams are actively involved in home care, particularly for populations facing greater social, functional, and access barriers.

Author Contributions

Bubacar Embaló - conception and design, analyzing and interpreting the data, and writing the article. Jhenyfer Amanda C. Canhete - analyzing and interpreting the data, writing the article, and critical revision. Gabriel Schmitt da Cruz - analyzing and interpreting the data, writing the article, and critical review. Daniela de Rossi Figueiredo - outlining, analyzing and interpreting the data, writing the article and critical review. Heloisa Godoi - conception and design - design, data analysis and interpretation, article writing and critical review. Ana Lúcia Schaefer Ferreira de Mello - conception and design, data interpretation, article writing, critical review and supervision. All the authors have approved the version to be published and are responsible for all aspects of the work.

Competing Interests

The authors declare no conflict of interests.

Data Availability Statement

The data supporting this study's findings are available on reasonable request. The dataset does not have open access due to ethical restrictions.

AI-Assisted Technologies Statement

Artificial intelligence (AI)-assisted tools were used during the revision of this manuscript to support English-language editing, improve readability, and refine the clarity and organization of the text. Specifically, OpenAI's ChatGPT was used to suggest revisions to grammar, wording, sentence structure, and linguistic presentation. AI-assisted tools were not used for data collection, quantitative or qualitative data analysis, or to independently determine the scientific interpretations and conclusions of the study. All AI-assisted suggestions were critically reviewed, verified, and edited by the authors, who take full responsibility for the accuracy, integrity, and content of the manuscript.

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