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Development of a consensus on a standard for oral health care in care-dependent older people: an e-Delphi study

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ABSTRACT

Background: Poor oral health is widespread in care-dependent older people, but no consensus for a minimum standard of oral health care currently exists.

Objectives: This study aimed to derive a consensus on oral health policy, access to dental care, oral hygiene measures and training levels.

Methods: The e-Delphi approach was applied utilising a select panel of interdisciplinary experts. Agreement amongst the subject experts was defined according to three measurements:

1. $\geq 70\%$ of experts' opinion fall into category "agree or strongly agree",
2. median score on the 5-point Likert scale ≥ 4 ,
3. interquartile range ≤ 1 .

Results: A total of 31 experts from 17 European countries participated in this survey. Agreement was achieved for a compulsory dental examination when a care-dependent older adult is admitted to a long-term care (LTC) facility. Care-dependent older adults should brush their teeth twice/day and regularly clean interproximal spaces and oral mucosa. Dentures should be rinsed after meals and thoroughly cleaned twice/day. The use of denture cleansing tablets was considered necessary. Dentures should be removed before sleeping and stored dry. High concentration fluoride toothpaste (5000 ppm) should be applied daily in care-dependent older adults with high caries risk. A short report on the oral health status of the older adult should be included within the overall medical assessment. The subject experts concluded that knowledge and training in oral health care for caregivers and family members of care-dependent older people was extremely important.

Conclusions: Using the e-Delphi method, healthcare professionals from different backgrounds and different countries agreed on a number of recommendations for a standard in oral health care for care-dependent older people.

Key words: e-Delphi study, Oral health, Oral hygiene, Oral health care training, Geriatric oral care, Institutionalised older adults, Care dependent older adults

INTRODUCTION

The average global life expectancy has steadily increased since the nineteenth century, especially in industrialized countries ¹. This trend coincides with a decline in fertility, leading to a dramatically expanded proportion of older persons. It has been estimated that between 2017 and 2050, the number of persons aged 80 years or over will increase more than three-folds, that is from the existing 137 to 425 million ². This continuous demographic change, known as the “silver tsunami”, will challenge the current healthcare systems which will need to adapt to the changing needs of the growing aging population.

Ageing is a complex process, with parts of it still not fully understood. It has been suggested that the multiple cellular and molecular functions are altered during the ageing process; these malfunctions subsequently facilitate a variety of chronic conditions. Such chronic conditions include cardiovascular diseases such as atherosclerosis; chronic obstructive pulmonary disease (COPD); rheumatoid arthritis (RA); diabetes; age-related macular degeneration (ARMD); neurocognitive disorders such as, but not restricted to, Parkinson’s and Alzheimer’s disease (AD); and many more. A large proportion of the older population is multimorbid, a condition defined as two or more chronic diseases coexisting in the same individual ^{3,4}. A rise in the prevalence of multimorbidity is directly related to increases in hospitalisation and ultimately care dependency.

The general health of care-dependent older people living in long-term care facilities (LTCs) is a major preoccupation and a priority of public healthcare systems, whereas oral health and access to dental treatments are rarely considered with the same importance ^{5,6}. Subsequently, older residents living in LTCs frequently present with poor oral health ⁷, which affects their general health and quality of life ^{8,9}. As tooth loss continues to decrease in older adults in developed countries, a significant number of residents in LTCs now present with a partial or complete natural dentition ^{10,11}. Oral hygiene measures to maintain the remaining natural dentition can be a challenge for care staff since they require considerably more time and effort than cleaning a complete dental prosthesis and/or wiping the oral mucosa. Furthermore, the oral health care for dependent older people is often complex due to their compromised general health, cognitive and/or physical impairments, and poor compliance. As oral health is often not a priority in residents’ health care plans, they rarely attend regular dental check-ups, thus often limiting the use of dental services to emergency treatments only ¹². One of the major barriers to improving oral health care in LTC residents is the lack of an oral health care policy that defines a standard of care with a protocol for oral health assessments and oral hygiene measures ^{13,14}. A recent collaborative European College of Gerodontology (ECG) and European Geriatric Medicine Society (EuGMS) publication stressed the need for appropriate legislative and policy developments with protocols for oral health prevention and promotion in institutional settings identifying specific measures that should be taken.

Multiple techniques and guidelines for oral health care have been reported in various studies, but they vary considerably between studies and countries ^{15,16}. However an international consensus concerning guidelines for oral health care in dependent older people has not yet been achieved. Such a consensus should ideally be defined by a panel of interdisciplinary health professionals who are responsible for delivering services for care-

dependent older adults. Such an approach would ensure an approach to oral health care delivery from a number of differing sectors for maximum effectiveness and feasibility. General healthcare policies should include access to oral health care for care-dependent older people. Professional knowledge and training in the area of geriatric oral health and its related care are equally important topics and should be implemented in the curricula of all health care professionals (i.e. dentists, dental hygienists, physicians, nurses, pharmacists, etc) on an undergraduate and postgraduate levels, along with sustained continuing education programs for those who have already graduated (<https://www.ncbi.nlm.nih.gov/pubmed/29266168>).

A widely used technique to obtain a consensus amongst a panel of experts is the “Delphi technique”, a method that is growing in popularity across many scientific disciplines, in particular in the domain of nursing care and in health research^{17,18}. It provides a platform for experts to share their opinions on a specific matter and re-consider it in the view from other experts. The utilisation of the Delphi technique is fundamentally based on anonymity, allowing participants to freely express their opinions, and avoid personal conflicts^{19,20}. Some characteristics of the Delphi method include (i) iteration, providing experts with the opportunity to reconsider and amend their statements; (ii) controlled feedback, to supply the participants with a review of other experts’ opinions; (iii) a quantitative illustration of the entire group’s opinions. A Delphi consensus is accomplished by a series of structured questionnaires filled in by a panel of selected experts in the field providing the individual participant with the feedback from the panel of experts until a group consensus is finally obtained^{21,22}. The e-Delphi approach applies the same principles but uses online questionnaires²³.

The purpose of this study was to obtain a consensus on a standard for oral health care in care-dependent older people from a group of multi-professional experts, by using the e-Delphi method. Three specific topics were considered in this study: health policy and access to dental care, oral hygiene methods and tools, as well as the knowledge and training of the various stakeholders.

MATERIALS AND METHODS

Selection of the panel of experts

In order to obtain a group of European multi-professional experts, the Academic Board of the European Geriatric Medicine Society (EuGMS) was contacted to provide a list of European experts including 15 physicians and 15 nurses with experience in geriatric medicine. The Council of the European College of Gerodontology (ECG) provided a list of 15 dentists with expertise in gerodontology from different European countries. A further list of 15 European dental hygienists specialised in geriatric oral hygiene care was proposed by the President of Swiss Dental Hygienists (SDH). An invitation letter, describing the objectives of the study and the Delphi method, was sent to the potential participants via electronic mail. Inclusion criteria for the participants in this study comprised:

- being knowledgeable in geriatrics,
- having more than five years of work experience with older patients,
- understanding the nature of a Delphi study and
- being willing to participate throughout the entire Delphi process.

The Delphi Questionnaire

The e-Delphi approach was selected as the most appropriate method for this study. A focus group of ten dentists and hygienists, working in the Division of Gerodontology and Removable Prosthodontics at the University of Geneva in Switzerland, pilot-tested the semi-structured survey. In order to collect as wide a range of possible answers for each question, the participants had the possibility to suggest further answers where none of the provided options fitted their opinions. The responses and suggestions obtained from the focus group served to finalize the pilot questionnaire, but were not included in the main study.

The pilot questionnaire (semi-structured) included a total of 30 questions, allowing the experts to express their views in a closed multiple-choice format, with the possibility of manually adding an answer to each question. A commercially available online survey-development tool (SurveyMonkey[®], SurveyMonkey Inc., San Mateo, CA, USA) was used to establish and distribute the questionnaire anonymously. The survey was divided into four parts: (Ia) socio-demographic details of the participants, (IIa) health policy and access to dental care, (IIIa) oral hygiene methods and tools, and (IVa), knowledge and training of the stakeholders. A link to access the online questionnaire was sent to the selected expert participants by email. Questions regarding oral hygiene methods and tools were only answered by dentists and dental hygienists. Questions, concerning the knowledge and training in oral health care for care-dependent older people in the medical/nursing/dental/dental hygiene schools, were asked only to the respective expert group. The collected responses were analysed automatically and displayed as a percentage using the online survey-development tool. In the next round, the same questionnaire was sent to the panellists, but with the results from the previous round appearing before each question. The participants were requested to re-consider their own responses in view of the responses from the other experts and then, were allowed to either maintain or adjust their responses accordingly. This controlled feedback was repeated until the response to a specific question achieved a consensus of $\geq 70\%$. The rounds needed to reach this pre-set frequency (70%) were designated as “pilot rounds” of which a maximum of three was planned.

The final consensus questionnaire was conceived from the answers, which received 50% or more agreement in from the pilot questionnaire. These answers were now re-worded as statements. The only exceptions were for those questions involving the oral hygiene tools. The consensus questionnaire contained the same three sections as the previous one: (IIb) health policy and access to dental care, (IIIb) oral hygiene methods and tools, and (IVb) knowledge and training for oral health care. The statements could be agreed or disagreed with, on a 5-point Likert scale (1: strongly disagree, 2: disagree, 3: neither agree nor disagree, 4: agree, and 5: strongly agree)²⁴. Each statement was set to appear separately on the screen to avoid straight-lining bias²⁵.

The panellists were then requested to complete the consensus questionnaire first without reference to previous results. For the next round, the percent of rating, mean, standard deviation, median, and interquartile range (IQR) of each score were calculated using IBM SPSS Statistics for Windows, version 25 (IBM Corp., Armonk, N.Y., USA) for every statement. Consensus was judged to have been obtained when the following three conditions were met:

1. $\geq 70\%$ of the experts scored between 4 and 5 (agree to strongly agree)^{26,27}

2. the median score was ≥ 4 ,
3. the IQR was ≤ 1 ²⁸⁻³⁰.

The IQR is usually used as one of indicators for Delphi consensus, due to its robustness as a statistical measure^{28,31,32}. An interquartile range ≤ 1 indicates that more than 50% of experts agreed on a certain point of the scale and was considered a threshold for reaching a consensus²⁸⁻³⁰. Statements that had reached a consensus, were eliminated, so the resulting questionnaires became progressively shorter. A summary of the statistical analysis from the previous round preceded each question. Again, the participants were invited to re-consider their responses in view of the answers from the other experts. The rounds used to obtain a consensus were designated as “consensus rounds” for which three rounds were set as maximum. The study design is illustrated in Figure 1.

Reliability of the questionnaire

Kendall’s tau-b correlation coefficient (range: -1 to 1) was used to test the reliability of the final questionnaire. This coefficient tested the ordinal association of the score rating of two similar questions. A rating of -1 indicates a non-correlation and therefore suggesting that they were completely different variables; while a rating of 1 indicates a complete correlation and therefore suggesting two identical variables. Kendall’s tau-b was calculated using IBM SPSS Statistics for Windows, version 25.

RESULTS

Panel selection and socio-demographic characteristics

The invitation letter to participate in this Delphi survey was sent to a total of 60 experts (15 physicians, 15 dentists, 15 dental hygienists and 15 nurses) from various European countries of whom 32 experts (11 physicians, 14 dentists, 6 dental hygienists, and 1 nurse) consented to participate. The sole participant from the nurses’ group was excluded from the analysis for statistical reasons. Finally, opinions of 31 participants (11 physicians, 14 dentists and 6 hygienists) from 17 countries were included for statistical analysis and interpretation.

The 11 expert physicians (age range: 35-71 years; Mean age: 49.6 ± 11.1 years) were from Belgium, Finland, Greece, Iceland, Italy, Lithuania, Poland, Portugal, Switzerland, Serbia and the United Kingdom. Their experiences in the management of care dependent older adults ranged between 5 and 15+ years (54.6% over 15 years; 27.3% for 10-15 years; 18.2% for 5-10 years).

The 14 expert dentists (age range: 32-62 years; Mean age: 52.5 ± 9.7 years) came from Belgium, Finland, France, Greece, Malta, Switzerland, Sweden, and the United Kingdom. 57.1%, 35.7%, and 7.1% of them had worked with care dependent older patients for 15 and more, 10-15, and 5-10 years, respectively.

The 6 expert dental hygienists (age range: 33-62 years; Mean age: 42.2 ± 12.29 years) worked in the Czech Republic, Ireland, Netherlands, Lithuania, Sweden and Switzerland, and were aged between 33 and 62 years (mean: 42.2 ± 12.29 years). In this group, 16.7% had over

15 years, 66.7% had 10-15, and 16.7% had 5-10 years of experience in providing oral hygiene for care dependent older patients.

Reliability of the questionnaire

Two sets of questions in the consensus questionnaire were considered similar, and therefore Kendall's tau-b correlation coefficient was calculated for them (Questions 7/24 and 8/22; Appendix 2). Kendall's tau-b values were high for both pairs of questions in both of the rounds in which they were included, illustrating a significant and good agreement on the two similar questions (Table 1).

Statement consensus

The study was conducted between October 2018 and June 2019. Three rounds were performed for the pilot and final questionnaires, which corresponded to the in providing oral hygiene for older people (Figure 1). Periodical contact and re-motivation were maintained with the experts during data collection in order to obtain a maximum number of responses. The response rate was 100% for each round (Table 2).

The results from the pilot rounds (1-3) are presented in Appendix 1. A total of 53 statements were subsequently extracted to form the final questionnaire. The results of the consensus rounds (4-6) are presented in Appendix 2. An IQR ≤ 1 was reached for all but one statement after the fifth round. The sixth-round questionnaire therefore comprised of a single question that applied only to the physicians. After round six, 39 of the 53 statements (Part IIb: 16 statements in IIIb: 12 statements, IVb: 11 statements) achieved an agreement of $\geq 70\%$ along with a median value equalling 4, and an IQR of ≤ 1 of the rating scores (Table 3).

Health policy and access to dental care

Regarding health policy and access to dental care, experts agreed that a dental screening examination by a dentist should be compulsory for every care dependent older patient at the time of admission to an LTC facility in addition, to the initial medical examination and geriatric assessment. Moreover, the costs involved for this dental screening examination should be covered by medical or dental health insurances (if available). A standardized, short report on the oral health status of the patient was considered important for the comprehensive geriatric assessment and care. Subsequent routine dental check-up examinations should be carried out by a dentist every six months. Tele-dentistry was considered a useful tool. The consensus indicated, that professional oral health care (POHC) should be performed by dental hygienists and/or dentists every 6 months, with a higher frequency in patients with the following conditions: dry mouth, Parkinson's disease, major neurocognitive disorders, physical handicap, immunodeficiency, dysphagia, and pneumonia. In uncooperative dependent older adults, positive reinforcement techniques should be used as a primary measure before considering advanced methods. Although various concepts concerning the preferred dental treatment in LTC residents were offered, no consensus was reached by the experts.

Oral hygiene methods and tools

Concerning oral hygiene methods and tools, the expert panels of dentists and dental hygienists agreed that a standard manual toothbrush and interdental brushes are necessary tools

for partially dentate older people. Older people should brush their teeth or have their teeth brushed twice a day, as well as regularly clean their interproximal spaces with an interdental brush by themselves or with the aid of their caregivers. In denture-wearing patients, denture brushes and cleansing tablets were considered as necessary adjuncts. Dentures should be rinsed after each meal and should be thoroughly cleaned twice a day. The edentulous ridges and the oral mucosa should be cleaned regularly using a soft toothbrush. Older persons should remove their dentures before sleeping and store them dry. In residents with a high caries risk, high concentration fluoride toothpaste (5000 ppm) should be applied daily. Although the regular use of mouth rinses is not recommended for LTC residents, the use of 0.12% chlorhexidine mouth rinse should be considered when the resident's plaque index is high.

Knowledge and training for oral health care

Regarding the knowledge and training in oral health care, experts from all the fields agreed that knowledge and training for diagnosis and management of oral health care for care dependent older people should be provided during the undergraduate, and structured postgraduate curricula, as well as in continuing education programs. Experts concurred that educating the older people's family members/caregivers on dental hygiene care was a "must".

DISCUSSION

The present study reports on an e-Delphi survey carried out in order to develop a consensus on a standard for oral health care in care-dependent older people, which could be used for health policy makers as well as serve as a guideline for health care professionals working in LTCs.

Since its original development in the 1950s, the Delphi method has been modified and adapted, rendering it a flexible tool which has been used in numerous studies³³. To date, there is no agreement on an ideal number of expert panellists needed to carry out this type of survey in the most efficient but also an inclusive manner^{22,34}. Indeed, a large variation in panel size is found in the literature, ranging from as small as 10 to a hundred experts or more^{35,36}. The "quality" of the experts is judged more important than the "number"³⁷. For the present study, an equal representation of the different expert groups was targeted, hence 15 specialists for each of the four specialist groups were contacted to participate. However, the refusal rate was quite high. Only one participant consented to participate in the nurses' group, therefore resulting in the elimination of this group from this e-Delphi survey. The most common reasons for refusal to participate given by the nurses were either a lack of time, or that they were not familiar with the dental subject. This high refusal rate may be indicative of either a low interest and/or the lack of knowledge in the domain of oral health. Ideally, the entire multi-professional team working towards oral health care for care-dependent older people should have been represented in this study, namely physicians, nurses, dentists, and dental hygienists. In the end, 31 experts participated in the e-Delphi Study. The smaller number was compensated by the panellists' experience and knowledge in caring for care-dependent older people. In addition, their expertise was confirmed by the board of the respective learned Societies, namely the

European College of Gerodontology (ECG), European Geriatric Medicine Society (EuGMS) and Swiss Dental Hygienists (SDH).

The development of the survey was carried out in various stages, from a focus group of 10 dentists to three rounds of a pilot questionnaire, which was the basis for the development of the final consensus questionnaire which was clear, objective, and inclusive of the most frequent expert opinions. Since Kendall's tau-b correlation values were highly significant for the two pairs of questions tested, the consensus questionnaire can be considered as reliable.

Health policy and access to dental care

Dental screening examination

An initial medical examination including a geriatric assessment is compulsory when a patient is admitted to an LTC, but this rarely includes a dental examination. The importance of an oral screening examination is increasing, as the prevalence of edentulism has decreased in recent years, and therefore elders tend to maintain natural teeth until a later age³⁸. Oral diseases associated with the retention of teeth, such as dental caries and root caries as well as periodontal diseases are commonly found in these older patients. They also frequently present functional impairment due to tooth loss and/or poorly adapted prostheses. An increased risk of poor oral health is present in care-dependent older patients, as various systemic risk factors, such as age-related diseases and/or their treatments are present. Medications frequently cause xerostomia, poor manual dexterity, and impaired vision, affect the ability to maintain proper oral hygiene while cognitive and/or physical disabilities change the patient's faculty and motivation for oral hygiene measures³⁸⁻⁴⁰. In order to diagnose and treat or prevent oral disease and dysfunction, an oral examination is crucial. The uptake of dental services is frequently poor in older people, and treatment is often requested only in emergency situations³⁸.

In the present e-Delphi survey, experts agreed that a dental screening examination by a dentist should be mandatory during the time of admission in to an LTC, and should be carried out alongside the medical examination. Likewise, the panellists concurred that this initial dental examination should be financially covered by the medical/dental health insurance, as previous studies have shown that cost is a major prohibitive factor for dental attendance, especially in countries like Switzerland where dental examinations present an out-of-pocket expense^{41,42}. Furthermore, the entire panel (100%) agreed that a standardised short report on the patients' individual oral health status and conditions should be included in the geriatric assessment. Indeed, it has been shown that oral health status is important for mastication, hence maintaining proper nutrient intake, stabilising and preventing chronic diseases and assuring the quality of life in older persons⁴³. Therefore, it should not be separated from the geriatric assessment and subsequent care plan.

Routine dental examinations

Experts further agreed that regular dental examinations should be carried out by a dentist every 6 months. Indeed, routine dental check-ups provide the opportunity of early detection of oral diseases, and enable the dentist to provide patients with prevention measures in order to lower the risks of functional impairments and other developing pathologies⁴⁴. As older people tend to be overly positive in the assessment of their oral health condition, examinations carried out only based on patient demand would be insufficient⁴⁵. The appropriate interval of dental recalls has been debated for decades, considering both clinical

benefits and cost-effectiveness. A final consensus has never been reached due to varying health policies in different countries and a lack of high quality research ⁴⁶. The interval of a six-monthly recall has remained common practice in many countries ⁴⁷. However, in “low risk” patients, longer intervals between 12 and 20 months are preferred ⁴⁸⁻⁵⁰. In this study, options of shorter recall intervals of monthly as well as every two months were presented in the first questionnaire, but no expert chose either of these answers (Appendix 2). Such frequent examinations would imply not only an important cost, but would also require substantial human resources, with a probably low clinical-effectiveness. Nonetheless, shorter recall intervals may be necessary for patients at risk, where an individualised oral health care plan should be implemented following the risk assessment at admission into the LTC. Between professional dental examinations, adequately trained non-dental LTC care professionals should provide regular initial oral health screenings using appropriate tools and immediately refer the patient to the dentist when necessary (<https://www.ncbi.nlm.nih.gov/pubmed/30471798>).

Intervals for professional oral health care (POHC)

Regular professional oral health care has been shown to reduce not only dental and periodontal disease, but also the onset or progression of some respiratory tract diseases, especially in high-risk elderly adults living in LTCs ⁵¹. Expert panellists acknowledged that POHC should be conducted by dental hygienists (or dentists if hygienists are not available) every six months. Moreover, an increase of POHC frequency was advised for elders suffering from conditions or diseases negatively impacting their oral health.

A decrease in saliva not only reduces oral comfort, but most importantly it diminishes the protection of oral soft tissue and teeth, increasing the risk of certain diseases such as dental caries ^{39,52}. This condition is mostly related to the intake of (multiple) medications ⁵². It may in certain cases also be caused by Parkinson’s disease, where patients present with both motor and non-motor symptoms, the latter consisting of several oral disorders, such as an increased prevalence of gingivitis, caries, orofacial pain and bruxism ^{53,54}. Major neurocognitive disorders may also negatively impact oral health, due to functional impairments, neglect in oral hygiene care, as well as a lack of cooperation concerning dental treatment and prevention ^{55,56}, similar to patients suffering from physical handicap ⁵⁷.

Patients with immunodeficiencies are at a higher risk of developing mucosal infections as well as periodontitis ⁵⁸. This comprises of patients with inherited immune system pathologies as well as patients with various acquired disorders. A declined immune function may be present in patients with diabetes and alcoholism, but it may also be related to physiological ageing. Older patients suffering from dysphagia are also at a higher risk of aspiration pneumonia, due to the inhalation of oral microbial flora ^{59,60}. Poor oral hygiene and swallowing disorders are the most prevalent risk factors associated with pneumonia in LTC residents ⁶¹. POHC may prevent caries, periodontal disease and aspiration pneumonia⁵¹ and should therefore be carried out regularly in LTC residents, especially when presenting with systemic diseases related to poor oral health.

Handling uncooperative patients

Neurocognitive disorders of diverse origin and severity may modify the behaviour in patients of any age, from being cooperative and able to undergo dental treatment in a general practice, to being uncooperative and requiring general anaesthesia for treatment ^{6,62,63}. In this

study, experts recommended that positive reinforcement techniques should be the first attempt to perform treatment and/or oral examination in uncooperative older patients rather than complex strategies such as procedures under general anaesthesia or sedation. As these interventions have associated risks and side-effects, which can be significant, they may further increase the morbidity in already frail older people ^{64,65}. Where sedation is necessary, the procedures and dosage should be judiciously considered to minimize the associated side effects ^{64,65}.

Management of patients with reduced mobility

Besides the ability to maintain their oral health, the ability to cooperate during treatment as well as patient mobility are important factors and these have to be considered in an oral care plan ⁶⁶. Regarding dental treatment, 67.7% of the experts stated that it should be performed in a dental practice on the LTC premises, but also 29% in the 1st round preferred a transfer to a private dental practice recognising the difficulties in transportation. Indeed, despite the difficulties in transporting frail elders with limited mobility to external dental practices, some advantages may justify the effort. Social engagement is important for older people, and a dental visit outside the nursing home may provide an opportunity for social participation, stimulating cognitive function and enhancing their quality of life ^{67,68}, as well as raising awareness to the existence of these dependent older persons in the society. Dental treatment in the LTCs with portable equipment or with a folding mobile dental unit was a preferred option for 42-48% of the experts respectively in round one, in agreement with previous studies identifying multiple barriers in domiciliary dental care provision for older people. Although this may not be a preferred option for dental care delivery, it should be born in mind that it is sometimes the last resort for providing dental care at all. Appropriate legislative guidelines, and educational initiatives are necessary to be developed in order to increase the level of domiciliary dental care provision for older people unable to access the dental offices.

When transportation poses a threat to a person's health, tele-dentistry may be a useful tool. LTC caregivers can capture oral images or videos with an intraoral camera, and send them via the internet to dentists. This enables diagnoses and/or second opinions to be made at a lower cost than a face-to-face examination by a dentist ⁶⁹. It can also minimize treatment sessions and chair-time during a dental appointment, as the diagnosis and treatment plan can often be done beforehand ⁷⁰. According to this study, teledentistry was acknowledged by the experts as a possible tool for oral examination in LTC residents, highlighting the importance of the use of modern technology to improve patient care.

Oral hygiene methods and tools

Dentate care-dependent elders

In this study, experts concluded that a standard manual toothbrush was a necessary tool for brushing teeth in care-dependent older persons, rather than an electric or sonic toothbrushes. This is in accordance with actual practices of care-dependent older residents, where manual toothbrushes are known to all and owned by at least 93% of them, while only few (17%) use electric toothbrushes ⁷¹. This might be due to difficulties in operating the on-switch, which is in many models protected by a waterproof plastic-cover, requiring substantial force and skills to handle. Toothbrush vibration and noises may frighten the older person, particularly when cognitive problems are present, and be perceived uncomfortable. Moreover, electric

toothbrushes can be expensive, while standard manual toothbrushes are more affordable. In contrast, the caring personnel often appreciate the efficiency of electric toothbrushes and considers them as time-saving⁷². However, the panellists prioritised the patient's perspective and the affordability, over these ergonomic considerations.

Brushing is an optimal approach to clean the surface of the teeth, except interdental sites^{73,74}. When interpreting the prevalence of the use of interdental cleaning tools, it has to be borne in mind that older patients have often lost several teeth and that the remaining teeth are not always adjacent to one another, hence not forming an interdental space. In order to clean interproximal spaces of LTC residents, experts preferred sticks and brushes over water flossers and dental floss. Despite dental floss being a well-known tool for cleaning interproximal spaces, only 27% of hospitalised older people use it daily, 21% use interdental brushes and 29% wooden sticks⁷¹. The lower preference of experts for the use of dental floss in dependent patients is perhaps due to its challenging technique. Many studies have failed to determine the effectiveness of using dental floss in plaque removal and reduction of gingivitis, possibly due to the difficulty of the technique or the lack of patient conformity^{75,76}. In contrast, interdental brushes have shown to be superior to dental floss in removing plaque, reducing periodontal pockets, maintain papillae level and reducing probing depth^{77,78}. Unlike the dental floss, the bristles of interdental brushes are capable of permeating the embrasures and adapt well to the exposed irregularities on the root surfaces. The efficiency of water flossers in cleaning interproximal spaces has been well demonstrated^{79,80}. However, their cost is significantly higher than other tools and they may be harmful when poorly used. The consensus in using interdental brushes in this study is in accordance with the consensus from the European Federation of Periodontology 2015 Workshop, which described the interdental brush method as the most effective technique in interproximal plaque removal⁸¹.

The expert panellists did not consider mouth rinses as a mandatory method for maintaining oral hygiene. Nevertheless, 0.12% chlorhexidine (CHX) mouth rinse was considered a useful product in patients with poor plaque control. The aim of using a mouthwash is to reduce the amount of microorganisms present in the oral cavity, minimising plaque formation and decreasing intrinsic malodour⁸². Nonetheless, in frail older people who frequently suffer from swallowing difficulties, managing liquids like mouthwashes can be challenging. Hence, the daily use of mouthwashes in all dependent residents may not be a reasonable approach. However, in patients with high plaque scores, CHX-containing mouthwashes are recognised as the gold-standard chemical method against bacterial plaque formation⁸³⁻⁸⁵. As no significant difference in efficacy concerning plaque control was found between 0.12% and 0.2% CHX mouth rinses, a low concentration (0.12%) is preferred in order to minimize side-effects⁸⁶. It was also shown that the use of a 0.12% CHX mouthwash prior to an intubation reduces the incidence of nosocomial pneumonia in patients undergoing surgery⁸⁷. The 0.12% CHX mouthwash has been suggested as a standard chemical agent to maintain oral hygiene in dependent institutionalized older people⁸⁸; however, its side-effects such as tooth discoloration, taste disturbance, mucosal irritation, and allergies^{89,90,91}.

Tongue cleaning has been shown to be important for preventing aspiration pneumonia in older people living in geriatric care facilities⁹². In the present study, 70% of experts considered tongue cleaning necessary for LTC residents in round three of the first questionnaire (Appendix 2). Nonetheless, a consensus for a specific instrument was not achieved, as 55%

recommended the use of a tongue scraper, while other tools such as gauzes, tongue brushes and toothbrushes were chosen by the other experts (Appendix 2). Some experts were of the opinion that any tool was possible for tongue cleaning. In the final questionnaire, only 60% of experts agreed that older people should regularly clean their tongues using a tongue scraper. Researchers have shown that there was no significant difference between tongue brushing and tongue scraping techniques in reducing plaque⁹³, thus any simple tool is useful, according to the experience of the user. The acceptance of tongue cleaning tools seems low, as they may trigger the gag reflex⁷¹.

Finally, 95% of the experts concurred that the residents should brush their teeth or have their teeth brushed twice a day. It has been demonstrated that brushing the teeth twice daily significantly improves gingival health⁹⁴. In the present study, the daily application of 5000 ppm fluoride toothpaste was recommended by the panellists for patients with high risk of caries. Root surface caries is a crucial problem and a significant factor for tooth loss in older persons⁹⁵. The daily utilization of a high-fluoride containing dentifrice (5000 ppm) has been shown to significantly improve surface hardness of untreated root caries lesions compared to regular fluoride-containing toothpaste (1350 ppm)^{96,97}.

Denture-wearing dependent elders

For denture-wearing older residents, all experts (100%) considered the use of a denture brush as mandatory for cleaning the dentures, while the majority (75%) also considered cleansing tablets as a necessary tool. Ineffective denture cleaning can affect patients' aesthetic appearance due to staining, can induce denture stomatitis and/or bad breath, and most importantly, enables the colonisation of the denture intaglio surface by pathogens that propagate gastrointestinal, and pleuropulmonary infections⁹⁸. Denture brushes contain longer and softer bristles compared to normal toothbrushes, making it easier to access hard-to-reach areas of the denture. They are considered a practical and affordable tool for maintaining denture hygiene. Besides the mechanical plaque-removal techniques, chemical agents such as cleansing tablets are usually recommended in association with brushing⁹⁹⁻¹⁰¹. The use of cleansing tablets has been shown to significantly reduce the total bacteria count on acrylic removable dentures¹⁰². However, some active ingredients present in denture cleansing tablets may alter the physical properties and surface topography of dentures. A prolonged use may affect the quality of the denture, subsequently, increasing the microbial retention on the altered denture surface¹⁰³⁻¹⁰⁵.

The other denture cleaning chemical agents and tools proposed in this study such as included diluted sodium hypochlorite, diluted vinegar, ultrasonic baths and magnetic cleaning baths with rotational steel bristles, were not considered as essential by the experts. Although chemical agents such as diluted sodium hypochlorite and diluted vinegar exhibit the potential for inhibiting bacterial growth, their effect on the acrylic resin (polymethylmethacrylate) is still controversial^{106,107}. Ultrasonic devices are as effective as other mechanical and chemical methods in biofilm removal¹⁰⁵; nonetheless, they have to be used by trained health care professionals and are expensive compared to other methods.

The panellists also suggested rinsing the dentures after each meal and thoroughly cleaning them twice/day. Despite limited qualified evidence concerning the frequency and method of denture cleaning¹⁰⁸, recent study has shown that daily cleaning of dentures is more

effective in minimizing microbial count than occasional interventions ¹⁰⁹. The frequency of denture cleaning becomes a question of feasibility for older people and/or caregivers who are responsible for this task. The option of denture cleaning three times per day was proposed in the first questionnaire, yet none of the experts chose this option (Appendix 2). Undoubtedly, cleaning dentures three times/day is neither realistic nor practical in LTCs, unlike twice/day. Rinsing dentures after each meal helps to remove loose food debris remaining on the intaglio surface and causing painful pressure on the mucosa.

In this study, experts recommended the dry storage of dentures overnight. It has been shown that denture-wearing at night is associated with inflammation of the oral mucosa and death from aspiration pneumonia ¹¹⁰. Maintaining dentures immersed in water is a common practice, as numerous practitioners and patients believed that dentures should not be stored dry overnight due to possible physical warping, albeit no scientific evidence supported that idea. Using 3-D methods combined with the participants' subjective assessments, recent findings from a double-blind RCT with a cross-over design have demonstrated that storage conditions, whether dry or immersed in a cleansing tablet solution, did neither cause denture warpage nor a loss in denture retention ¹¹¹. Taking into consideration the limited scientific evidence on the best denture storage conditions and until further evidence is available, the panel recommended that dentures should be removed, before bedtime, cleaned with a denture brush, immersed in a cleansing tablet solution according to the manufacturer's instructions, rinsed with water, then dried and stored dry overnight.

Concerning edentulous ridges and buccal mucosa, experts recommended regular cleaning with a soft toothbrush. As a result of the age-related lower physiological self-cleansing mechanisms, the edentulous ridges, tongue, palate, and oral mucosa can become significant microbial reservoirs, hence regular cleaning should be carried out in order to minimize oral infections as well as aspiration pneumonia and its associated complications ^{112,113}.

Knowledge and training for oral health care

The rapidly increasing older population will undoubtedly challenge current healthcare systems, and it has been predicted that we will face a lack of caregivers for them. In this study, all experts (100%) acknowledged the importance of family members as caregivers, advocating that dental professionals should provide education concerning dental hygiene care for older people to family members of LTC residents. Family caregivers have long been considered as the backbone of health care systems, providing informal unpaid care, especially for persons suffering from dementia ^{114,115}. Family caregivers are commonly under-recognised, progressively overburdened, not only physically, but also mentally, emotionally and financially ^{115,116}. Developing a practical long term oral healthcare system requires a multifaceted support for these family caregivers to ensure not only their oral health care knowledge, but also their own well-being while continuing to provide care for their older relatives ¹¹⁶.

Physician, dentist and hygienist experts were aware that knowledge and training for diagnosis and management of oral health care for dependent older people are fundamental and should be provided in their schools during both the undergraduate and structured postgraduate curriculum, as well as during continuing education. Dental treatments and care plans are different for dependent older people, where sometimes a palliative care plan and treatment becomes the first choice ^{117,118}. As a multidisciplinary care team is required, knowledge and

training on oral care in dependent older people is mandatory for every professional involved (<https://www.ncbi.nlm.nih.gov/pubmed/29266168>). Interestingly, one question regarding knowledge and training for diagnostic and management of oral health care for dependent older people during undergraduate curriculum in medical school achieved an agreement of only 81.8% from the geriatricians while the agreement in the groups of dentists and hygienists for their corresponding undergraduate curriculum was of 100%. One physician who disagreed with this statement claimed that the medical undergraduate curriculum is already overloaded with medical content, and that limited time was dedicated to geriatrics. Additional content concerning dental diagnosis and management for dependent elders would therefore be difficult to add into the curriculum. In this expert's opinion, a guideline for referring and motivating older people to see a dentist when needed would be more important. Nevertheless, all experts finally agreed that it was necessary to integrate dental education for dependent older patients in every level of professional education, with final details on the educational contents requiring discussion and adaptation for each country.

Attitude of healthcare professionals

The insufficient importance given to oral care and knowledge of health professionals and healthcare workers has long been an issue ¹¹⁹⁻¹²¹, yet the same problems persist, highlighted, amongst others, by the lack of participation of the nurses in this study. This might be due to increased workload, limited staff, and the lack of an accountable structure. Establishing a proper long-term multi-professional oral health care system for dependent older people requires the evolution of various factors including public health policy, infrastructure, as well as an optimal working environment, appropriate salary, and sufficient amount of LTC staff. Attitudes towards changing oral healthcare must evolve, and proper education with training of every professional working in LTCs, as well as the family members of dependent older people are necessary. Knowledge gaps should be addressed by further research with the aim of providing a good quality of life as well as adequate oral health for the institutionalised older people.

SUMMARY and CONCLUSION

The results of this e-Delphi study commissioned to obtain a consensus for a standard in oral health care for care-dependent older people.

Health policy

At the onset of dependency, an oral examination should be performed by a dentist at admission to an LTC, and the cost being covered by medical/dental insurances. A short, standardised report on the oral health status of the patient, including a prescription of specific preventive measures, should be part of any geriatric assessment and care plan. Subsequent dental recall visits by a dentist should take place every 6 months. Employing modern technologies like teledentistry should be encouraged when necessary.

Prevention

POHC should be carried out by dental hygienists or dentists every 6 months, except in particular conditions, where the recall intervals should be shorter. Positive reinforcement techniques should be used to perform oral hygiene measures when dealing with uncooperative older patients. Teeth and dentures should be brushed twice a day with a manual toothbrush and denture brush, respectively. In addition, dentures should be rinsed after each meal. When adjacent teeth are present, interdental brushes should be used regularly. The oral mucosa should be cleaned routinely with a soft toothbrush.

In case of high caries risk, 5000 ppm fluoride toothpaste should be prescribed daily. When high levels of visible plaque are present, 0.12% Chlorhexidine mouthrinse may be administered.

Denture use

At night, dentures should not be worn. Before bedtime they should be cleaned with a denture brush, immersed in a cleansing tablet solution for a short time, rinsed with water, dried, and then stored dry overnight.

Education

Undergraduate and postgraduate curricula as well as continuing education programs on oral health for older people are necessary for medical, dental and dental hygienist students and professionals. Family members of care-dependent older people should also be educated on oral health care and collaborate with the health professionals as a team.

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