Effectiveness of health promotion programs in improving oral health of older people in residential aged care facilities: Protocol for a Systematic Review

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Research Article

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Abstract

Background

Globally, there is a demographic transition with population age structures inverting increasing the number of older people relative to other age groups. Oral health in older people is found to be very poor as a result of several factors including deterioration in systemic health, cognitive impairments and limited ability to perform routine oral hygiene measures in addition to the process of ageing. This deterioration is exacerbated in older persons living in residential aged care facilities with most of them experiencing dental diseases that require complex dental treatment. Dental diseases are largely preventable with several health promotion interventions have been found to have varying degrees of success in residential aged care settings. Given the modifiable nature of risk factors involved in the occurrence of dental diseases, behaviour change interventions that target oral health behaviours are valuable in effecting behaviour change thereby leading to an improvement in oral health status among older people people in residential aged care facilities. However, currently there is a paucity of research that acts as an evidence base for designing and optimising behaviour change interventions in residential aged care settings. This systematic review will investigate the components of health promotion interventions associated with changes in oral health status among older people living in residential aged care facilities.

Objective

The aim of this study is to identify all oral health promotion interventions with a behavioural component designed and trialled for the improvement of oral health status in residential aged care facilities, and to identify the behaviour change techniques used in such interventions using the Behaviour Change Techniques Taxonomy Version 1 (BCTTv1).

Methods/Design:

This systematic review will be reported in line with the Preferred Reporting Items for Systematic Reviews and Meta-analyses guidance. Randomized controlled trials and non-randomized intervention studies aimed at improving oral health status among older persons living in RACF’s will be included. MEDLINE, Cochrane CENTRAL, Cochrane Database of Systematic Reviews (CDSR), EMBASE, PsycINFO, CINAHL and Web of Sciences will be screened for articles relevant to the review; Titles, abstract screening, full-text review and data extraction will be performed independently by two reviewers. Data will be recorded in a pretested form, any disagreements in screening or data extraction and coding will be resolved by discussion with a third reviewer. Risk of bias in randomized controlled trials will be assessed using the Cochrane Risk of Bias 2 (RoB2) tool, the Risk of bias in non-randomized studies of interventions (ROBINS-I) tool will be used for non-randomized studies. A narrative synthesis of the association between behavior change techniques and its effect on improving oral health outcomes in residential aged care facilities will
be provided. Where the data is sufficiently homogenous, the data will be pooled and statistically analysed.

Discussion

This review will be of value to older persons residing in residential aged care facilities, health care professionals and policy makers. The conclusions of this review will be used to design an appropriate intervention with effective behavior change techniques to improve oral health status among older people in residential aged care facilities in rural Victoria.

Systematic Review Registration:

PROSPERO reference: CRD42022375632

Introduction

It is a well-established fact that good oral health is an essential component of general health and that maintaining a good level of oral health is important for the quality of life of an individual.\textsuperscript{1,2} Important activities of daily living such as talking, chewing, eating and maintaining good social relationships with others are all influenced by oral health.\textsuperscript{3} Deterioration in oral health resulting from dental caries, tooth loss due to periodontitis, mucosal lesions or other dental diseases can lead to functional limitations, pain, malnutrition and social isolation.\textsuperscript{4} Poor oral health can also exacerbate certain systemic conditions such as diabetes mellitus, cardiovascular disease, liver disease and pulmonary infections.\textsuperscript{5,6,7}

Modelling research from the 2017 Global Burden of Disease, Injuries and risk factors study predicts that there will be a major shift in the age structure of the population with almost 2.37 billion people being aged over 65 years by the year 2100.\textsuperscript{8} This demographic transition makes it necessary for oral health of older people to be prioritized by policymakers as most common oral diseases are preventable. For the older people, poor oral health can have drastic negative consequences as this is a population that frequently has several comorbidities in conjunction with oral diseases that require complex treatment. Several studies have established that oral health of older persons living in residential aged care facilities (RACF’s) is very poor and that older people living in RACF’s often wear unhygienic dentures as a result of poor denture cleaning practices.\textsuperscript{9,10} Previous research has also documented that the oral health of older people declines rapidly after moving to RACF’s.\textsuperscript{11,12} This decline is owing to a multitude of factors such as xerostomia (dry mouth) due to intake of multiple medications or other causes, reduced number of functional teeth and reduced bite force and inability to carry out self-care as a result of complex physical or neurological disabilities.\textsuperscript{13}
The foremost cause of common dental diseases is dental plaque which is a biofilm that contains bacteria and its by-products and adheres to the teeth and surfaces of dentures.\textsuperscript{14} Regular removal of dental plaque is necessary to prevent the onset and progression of dental caries and periodontitis. Without regular oral hygiene measures to remove dental plaque, microbial colonies in the biofilm are driven to dysbiosis resulting in plaque becoming more pathogenic.\textsuperscript{14} In addition to local progression of disease at the sites that dental plaque is present, hematogenous dissemination of bacteria is also possible resulting in release of inflammatory mediators and amplification of systemic inflammation in certain individuals.\textsuperscript{15} However, it has been established from previous studies that older people people in residential aged care facilities had high amounts of plaque even when oral care assistance was being provided.\textsuperscript{16,17} Older people living in rural areas are further at a disadvantage because of poor access to dental care in rural areas in comparison to urban areas. Consequently, older people residing in rural areas are three times more likely to have no natural teeth and utilize dental services less in comparison to their urban counterparts.\textsuperscript{18}

Several oral health promotion programs targeting either residents or care staff have been implemented all over the world in RACF’s with varying degrees of success.\textsuperscript{19,20} Encouraging residents or care staff of residents to maintain oral health by regularly practicing good oral and denture hygiene measures requires behaviour change; behaviour change interventions are defined as co-ordinated set of activities that are designed to change specified patterns of behaviour.\textsuperscript{21} The National Institute for Health and Care Excellence (NICE) reports that investigating which behaviour change techniques are effective in instigating and maintaining behaviour change is a research priority.\textsuperscript{22} Using a standardised language to describe behaviour change intervention content has become possible since the development of the taxonomy of behaviour changes. The behaviour change techniques taxonomy (BCTTv1) is a cross-domain, hierarchically structured taxonomy of 93 distinct behaviour change techniques which offers a reliable method of specifying, interpreting and implementing the active ingredients of a behaviour change intervention.\textsuperscript{23}

Previous research on implementation strategies used in oral health promotion programs among care staff in RACF’s has identified that certain behaviour change techniques that target specified determinants of behaviour change such as increasing memory, feedback of clinical outcomes and mobilising social norm are associated with greater effect in improvement of oral health among older persons residing in RACF’s.\textsuperscript{24} To the authors’ knowledge, no systematic review has investigated the content of health promotion interventions to improve oral health of older people in RACF’s using BCTTv1 to identify and code intervention content in terms of the behaviour change techniques employed. Hence, we aim to systematically investigate the behaviour change components and outcomes of interventions in improving the oral health among older people in RACF’s. We anticipate that the results of the review could inform us of the most efficient behaviour change techniques which could then be recommended for implementation in RACF’s.

**Methods**
Inclusion Criteria

We will include all published journal articles in English-language on oral health promotion interventions for older people in RACF’s. Older people includes all older persons aged 65 years and above who are residing in RACF’s. Time restrictions will not be applied as we have a keen interest in understanding how behavior change interventions have evolved over time and also because of the limited number of articles that were obtained during preliminary database searches. The interventions targeting either or both older people residents and care staff in RACF’s will be included. All randomized controlled trials, quasi randomized trials and non-randomized before and after intervention comparison studies, intervention and control comparison studies will be included. Health promotion interventions may be any intervention that targets behaviour change such as; interventions administered by dentists or dental hygienists which may include one or more of the following, PowerPoint presentations on oral hygiene, good oral care and denture hygiene, demonstration of brushing or denture cleaning techniques, hands-on training in tooth brushing techniques, group discussions, distribution of booklets, practical advice, lectures, workshops, videos on oral health and hygiene. Studies reporting the outcome in terms of the primary outcome variable which is improvement in oral health status of older people will be included in the review. This could be indicators of oral hygiene namely plaque and gingivitis measured using standard indices such as the plaque index and gingival bleeding index and other indicators of oral health such as the presence or absence of denture stomatitis, angular cheilitis, mucositis, candidiasis, dry mouth and mucosal lesions. Our secondary outcomes include variables reporting on any other oral health related outcomes which maybe subjective or objective, clinical or non-clinical such as improvement in oral health knowledge, attitudes, beliefs and practices, self-rated oral health, oral health related quality of life (OHR-QoL), oral health literacy, oral hygiene behaviors, denture hygiene behaviors. Articles which report the outcomes in terms of our secondary outcome variables will also be included in the review.

Exclusion Criteria

All articles published in any language other than English will be excluded. Articles where the study population is below 65 years of age will be excluded. Editorials, letters to editor, opinion pieces, systematic reviews, narrative reviews, conference papers, conference reviews, books and book chapters will also be excluded. Articles related to oral health promotion interventions in community dwelling older people people will be excluded. Articles where the intervention solely focuses on effectiveness of oral care products or drugs in improvement of oral health in older people living in RACF’s will be excluded. Likewise, articles that solely focus on professional clinical oral care interventions in the improvement of oral health in older people will also be excluded. Articles where the outcomes reported are not oral health-related will be excluded.

SEARCH STRATEGY
Relevant articles for inclusion in the review will be identified by searching the following databases; Medical Literature Analysis and Retrieval System online (MEDLINE), Cochrane Central Register of controlled trials (CENTRAL), Cochrane Database for Systematic Reviews (CDSR), EBSCO Cumulative Index to Nursing and Allied Health Literature (CINAHL), Excerpta Medica Database (EMBASE), Web of Sciences and PsyCInfo. In addition, the reference list of all studies included in the review will be hand-searched to identify additional studies. Likewise, the reference list of any systematic reviews on oral health promotion interventions for older persons living in RACF’s will also be screened for relevant articles. A detailed search strategy will be developed for each database, this will be based on search strategy developed for searching the MEDLINE database but will be revised for searching other databases with consideration to different Subject headings/ terms/ key words in different databases. The search strategy to be used in MEDLINE database is given in Table 1. These search terms will remain identical while searching all databases except for MeSH terms. All search terms under each concept will be combined using the OR operator, and all the search terms under the three concepts will be combined using the AND operator.

### Table 1

<table>
<thead>
<tr>
<th>Concept 1 (Population of interest)</th>
<th>Concept 2 (Intervention)</th>
<th>Concept 3 (Outcome)</th>
</tr>
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<tr>
<td>“Older persons in residential aged care” OR “nursing home” OR “nursing homes” OR “residential aged care facility” OR “residential aged care facilities” OR “older people” OR “aged care” OR “older persons” OR “older people residents” OR “older people in long-term care facilities” OR “older people in long term care” OR “older people in long term care facility” OR “homes for the aged” OR “old age home” OR “old age homes” OR “aged”</td>
<td>“Health education” OR “behavior change” OR “behavior modification” OR “behaviour change” OR “behaviour modification” OR “health promotion” OR “health program” OR “health programs” OR “behavior change technique” OR “behaviour change technique” OR “conditioning therapy” OR “behavior therapy” OR “behaviour therapy” OR “behavior therapies” OR “behaviour therapies” OR “modelling” OR “self-efficacy” OR “motivational interviewing” OR “conditioning therapies” OR “facilitation of behavior” OR “facilitation of behaviour” OR “action control” OR “maintenance” OR “relapse prevention” OR “practice” OR “guided practice” OR “health related behavior” OR “health related behaviours” OR “health behaviour” OR “health behaviors” OR “health behaviours” OR “behavior change techniques” OR “behaviour change techniques” OR “locus of control” OR “sense of control” OR “internal external control”</td>
<td>“Oral health” OR “dental health” OR “dentistry” OR “dentist” OR “dental hygiene” OR “oral health related quality of life” OR “dentists” OR “oral hygiene” OR “oral health therapist” OR “dental caries” OR “gingivitis” OR “dental hygienists” OR “dental care”</td>
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**DATA COLLECTION AND ANALYSIS**
The articles retrieved by the searches will be imported to EndNote 20 (Thomson Reuters, Philadelphia, PA, USA) reference management software and duplicates will be removed. Two independent reviewers (NA and SR) will evaluate the titles and abstracts articles returned by the searches against the inclusion and exclusion criteria for the review. Articles that do not meet the eligibility criteria will be removed. The full-text of all the remaining articles will be retrieved for further assessment. Based on the information given in the full-text of the articles, two reviewers (NA and SR) will decide which articles to include in the review, any discrepancies between the two reviewers will be resolved by discussion with a third reviewer (SKT). Records will be kept of all articles excluded at this stage and the reasons for exclusion.

**DATA EXTRACTION AND MANAGEMENT**

Two review authors (NA and SR) will independently retrieve extract data from the articles included in the review using a customized data extraction form piloted prior to use. The data extraction form will be used to extract relevant data on the study design, study setting, study duration; population demographics, baseline characteristics; details of interventions including the type of intervention, number of participants and intervention provider; control conditions or comparisons; methodological issues, follow-up, outcome measures, results; recruitment, study completion rates and information needed for assessment of risk of bias.

Where there is missing data in any study, the original authors will be contacted to obtain data where possible. In case of multiple publications of the same study, we will try to extract and combine all data where possible. Where this is not possible, the original publication will be given priority over others.

COVIDENCE systematic review tool will be used for data extraction and quality assessment by both review authors NA and SR. As COVIDENCE provides options to choose templates for risk of bias assessment we will use custom templates for risk of bias assessment based on whether we are assessing an RCT or observational studies.

**BCT CODING**

The health promotion intervention content will be coded according to the behaviour change technique taxonomy (v1) of 93 hierarchically clustered techniques. Two qualified coders (NA and SR) will independently code behaviour change techniques, Kappa statistics and percentage disagreement will be calculated for the same. The two reviewers will resolve any discrepancies through discussion with third reviewer involvement to resolve differences if necessary. The intervention content will be coded for the presence (+) or absence (-) of behaviour change techniques (BCTs). To evaluate the use of BCTs in interventions, the percentage of individual BCTs across interventions and total number of BCTs per intervention will be calculated. The BCTs which have the most effect on our primary and secondary outcomes will be identified and tabulated.

**RISK OF BIAS ASSESSMENT**
As the review will include both randomized controlled trials and non-randomized studies, risk of bias assessment tools appropriate for the study design will be used. Two independent review authors will independently assess the risk of bias in each study included in the review. For randomized controlled trials (RCT) the risk of bias 2 tool (RoB2) following guidance from the Cochrane Handbook for Systematic Reviews of Interventions will be used. All the five domains of the RoB2 tool will be considered while assessing risk of bias namely evidence of bias arising from randomization process, deviation from intended intervention, missing outcome data, measurement of outcome and selective reporting of results. This tool will be used to report whether a RCT is at high risk, some concerns or low risk of bias.

For non-randomized studies, the risk of bias in non-randomized studies of interventions (ROBINS-I) tool will be used. Seven domains of the ROBINS-I tool will be considered, bias arising due to confounding, selection of participants in the study, classification of interventions, deviation from intended interventions, missing data, measurement of outcomes and selective reporting of results will be assessed. The ROBINS-I tool will be used to decide whether a non-randomized intervention study is at low risk of bias, moderate risk, serious risk, critical risk or has no information on which to base a judgment of risk of bias.

A summary of the risk of bias assessment and quality of the studies included in will be provided in the review and a narrative account of any serious flaws encountered in the studies will also be provided.

**DATA SYNTHESIS**

A narrative synthesis of the findings from the included studies will be provided focused around the type of interventions, target population characteristics, intervention content and robustness of evidence. Summaries of intervention effects in each study will be provided with calculation of risk ratio for dichotomous outcomes or standardized mean difference for continuous outcomes.

Careful consideration will be given to the appropriateness of conducting a meta-analysis. We anticipate that there will be limited scope for conducting a meta-analysis owing to the differences in intervention content, potential BCT’s and outcome measures across a small number of randomized controlled trials. However, we will summarise the data statistically where data available is sufficiently similar and of sufficient quality. Diversity across studies will be qualitatively assessed in terms of intervention (content, duration, frequency, provider and setting), participant characteristics, outcome measures and follow-up. If two or more studies are considered homogenous, we will analyze the statistical heterogeneity of the data using the Chi-square test and $I^2$ statistic. The level of significance for Chi-square test will be set at $P < 0.1$. Values of $I^2$ greater than 50% will be considered as indicative of substantial heterogeneity. In case of substantial heterogeneity, we will pool studies using the random effects model and in case of low or no heterogeneity, we will pool studies using the fixed effects model. Sensitivity analysis will be performed to investigate the effect of inclusion or exclusion of heterogenous studies. Evidence of publication bias will also be assessed.
Discussion And Dissemination

Evidence from previous research has established that older people living in residential aged care facilities have a high risk of developing dental diseases. Common dental diseases such as dental caries and periodontitis are largely preventable, and several oral health promotion interventions have proven to be effective in residential aged care settings. However, reviews analysing the active component of such health promotion interventions are absent. A systematic review of literature analysing the content of oral health promotion interventions in terms of the behaviour change techniques (BCT’s) employed will contribute to the understanding of how BCT’s fit into affecting changes in the oral health status of older persons living in RACF’s. The Encouraging Best Practice in Residential Aged Care (EBPRAC) program established by the Australian Government reiterates in its final report the importance of behaviour change interventions in maintaining oral health in older people, especially in residents with cognitive impairments as a result of ageing. Data from the National Survey of Adult Oral Health (2004–2006) shows that there is an increasing population of older people living in rural and regional areas in Australia. It has also been demonstrated from previous studies that access to dental care is poorer in regional and rural areas which results in inequities in oral health outcomes between older people living in urban and rural areas. This disadvantage in accessing quality dental care is further exacerbated for older people living in RACF’s resulting in a marked decline in oral health after enrolment in RACF’s. Therefore, an intervention that can address the oral health needs of older people in RACF’s in rural areas in a sustainable manner is needed. This systematic review is the first step in designing a behavior change intervention to improve oral health of residents living in rural and regional areas of Victoria, Australia.

The findings of this systematic review will be reported based on the guidelines from Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement. The results of the review will be submitted for publication in peer-reviewed journals. Other forms of dissemination will include engagement with stakeholders involved in residential aged care in rural Victoria, the results of this review will be used to develop a health promotion intervention with an active behaviour change component to improve oral health status of residents in RACF’s.

Declarations

- Ethics approval and consent to participate - Not applicable
- Consent for publication - Not applicable
- Availability of data and materials - The data we are using for the systematic review is publicly available in databases except for some articles which may not have open access.
- Competing interests - The authors declare no conflicts of interest.
- Funding - This project is being funded by La Trobe Rural Health School, Bendigo, Victoria, Australia
- Authors’ contributions - Nesa Aurlene, Santosh Kumar Tadakamadla and Melanie Bish conceived the idea for the systematic review, designed the review and envisioned the protocol according to which
the systematic review is to be conducted. Nesa Aurlene wrote the main manuscript text, Sindhu Ravichandran proofread the manuscript and prepared the tables. Nesa Aurlene prepared the final draft of the manuscript which was reviewed by Santosh Kumar Tadakamadla, Sindhu Ravichandran and Melanie Bish.

- Acknowledgements - Not applicable
- The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

References


