

A bi-level intervention to improve oral hygiene of older and disabled adults in low-income housing: results of a pilot study

S. Reisine¹, J.J. Schensul², R. Goldblatt¹, K. Radda², C. Foster-Bey², C. Acosta-Glynn², L. Miron-Carcamo¹ and E. Ioannidou¹

¹University of Connecticut School of Dental Medicine, Farmington, CT, USA; ²Institute for Community Research, Hartford, CT, USA; ³North Central Area Agency on Aging, Hartford, CT, USA

Objective: This paper describes the results of a bi-level intervention, using a cognitive-behavioral theoretical approach, to improve the oral hygiene of older adults and the disabled in community-based low income senior housing. **Methods:** The bi-level pilot intervention consisted of an on-site tailored adapted motivational interviewing (AMI) session and two oral health fairs, supported by a resident campaign committee, to change community norms. All materials were available in English and Spanish. Participants completed a survey consisting of 12 domains that provided the basis for tailoring the AMI and shaping the campaigns. The domains were activities of daily living (ADLs), access to oral health information, oral hygiene status, dental knowledge, hygiene behaviors, importance of oral hygiene, self-efficacy/locus of control, diet, intentions, self-management worries/fears, perceived risk and dry mouth. **Main Outcome Measures:** Each participant received clinical assessments consisting of full-mouth plaque score (PS) and gingival index (GI) before the intervention and at three months. **Results:** Twenty-seven residents with at least one tooth completed all phases of the study. The mean number of domains requiring attention was 4.5 (SD 1.6) with a range of one to seven. Mean baseline PS was 83% (SD 16%) which improved significantly to 58% (SD 31%); mean baseline GI was 1.15 (SD 0.61) and improved significantly to 0.49 (SD 0.46). **Conclusions:** This pilot study supports the feasibility and acceptability of a tailored oral hygiene intervention among older and disabled adults living in low income senior housing. Although a small sample, the study demonstrated significant improvements in both plaque and gingival scores three months after the bi-level intervention.

Key words: oral health, older adults, adapted motivational interviewing, motivational interviewing, America

Introduction

The oral health of older adults, especially those 65 and over and those with disabilities, is a much neglected area despite the high prevalence of decay, periodontal disease, edentulism, unmet treatment needs and impaired oral health related quality of life in these populations (Anders and Davis, 2010; Griffin *et al.*, 2012). Further, significant racial/ethnic and class disparities exist with respect to the burden of oral disease, access to oral health care, and diminished oral health-related quality of life among older and disabled adults (Griffin *et al.*, 2012; Lamster *et al.*, 2008). The World Health Organization and other international as well as national agencies have noted the need for theoretically driven intervention research to improve oral health in general, and specifically in older, and especially in low income older adults and those with disabilities (Bartholomew and Mullen, 2011; Petersen and Yamamoto, 2005). The Integrative Model of Behavioral Prediction (IM) (Fishbein and Yzer, 2005; Fishbein and DiClemente, 2009) offers a theoretical framework that has been applied to public health interventions with success. The IM proposes that attitudes about the outcomes and perceived risks, normative beliefs about the importance of the health behaviors and self-efficacy shape intention which is the key cognitive factor in performing the behavior. Individuals also must have the requisite skills

to perform the behaviors effectively (Bandura, 1989).

Most health behavioral interventions guided by the IM are implemented at the individual level. Recognizing, however, that individual level cognitive behavioral interventions have limited capacity to maintain change, many researchers propose multi-component, multi-level intervention approaches in producing both better immediate outcomes, and higher potential for sustainability (Schensul *et al.*, 2009). There is a growing literature on the effectiveness of community-run campaigns based on principles of community-based participatory research that focus on specific health problems (Reininger, *et al.*, 2010), some using a multilevel approach (Schensul *et al.*, 2009). A multilevel approach that supports and reinforces the same oral health norms, beliefs and health practices both publicly and at the individual level should offer better potential for maximizing outcome effects in community settings as well as paving the way for future sustainability.

This paper describes the results of a pilot intervention to improve oral hygiene beliefs, attitudes and behavioral skills among older adults and adults with disabilities living in low income senior housing. Approximately one third of low income older adults (over 1.5 million people) reside in publically subsidized housing for low income adults and those with disabilities nationally and this number is expected to grow exponentially in the next 20-30 years (JCHSHU, 2014).

These buildings are often ignored by service providers. Residents are underserved, socially isolated, have significant health needs and are responsive to programs to improve their wellbeing. The intervention was based on the Integrative Model of Behavioral Prediction and practice to mastery and was operationalized at two levels: individual through face to face adapted motivational interviewing and, at the building level, through the implementation of oral health promotion campaigns delivered by study staff together with building residents. The study was limited to a relatively small sample because of funding constraints and aimed to recruit, survey and, for many, clinically assess about 30 residents.

Methods

Participants were recruited from a low income public housing residence for ethnically and racially diverse older adults aged 62 and above, and those with disabilities in a small industrial city in Central Connecticut. The residence consisted of two towers connected by a large community room, and included 221 one-bedroom units and 240 adults. Intervention inclusion criteria included being: 1, resident in the building; 2, judged able to complete surveys; 3, cognitively able to give consent; and, 4, willing to tolerate a clinical assessment. Exclusion criteria included: 1, a history of heart valve replacement, endocarditis, or joint replacement, or arterial stent placement or myocardial infarction (heart attack) in the previous 6 months; 2, sole use of languages other than English or Spanish; 3, inability to give consent; 4, under a conservatorship. The building housed first language English and Spanish speakers and the intervention was conducted by research staff fluent in one or both languages. The study tested the hypothesis that a tailored face to face intervention would have a positive effect on the oral health self-management of participants as measured by statistically significant improvements in gingival index and plaque score. The study also hypothesized that the face to face intervention would have a positive effect on cognitive domains believed to influence behavioral improvements. Finally the study assessed the feasibility and acceptability of a resident driven oral health norms campaign. The study design involved recruitment of volunteers in the study building into the overall study, an oral health campaign committee and/or a face to face intervention. Volunteers were exposed to a face to face intervention and two resident driven oral health campaigns designed to inform and improve oral health and hygiene that took place over a period of about six months. All volunteers for the face to face intervention were administered a clinical assessment to measure gingival index and plaque scores and a survey with scales measuring cognitive domains and reported oral hygiene practices, prior to and after the intervention. Survey-only volunteers were administered a survey before and after the intervention period but no clinical assessment. The study was a collaboration of the University of Connecticut School of Dental Medicine and the Institute for Community Research, and was approved by UCHC Institutional Review Board, and the North Central Area Agency on Aging.

Adapted Motivational Interviewing (AMI) is an approach derived from motivational interviewing. Motivational Interviewing engages participants in a facilitated open ended dialogue through which they analyze their own situation and devise a plan for changing it. Critics of motivational interviewing raise concerns about lack of consistency in

implementation and difficulty in evaluation. AMI addresses these problems by utilizing a structured scripted intervention process based on content tailored or customized to the individual. A recent meta-analysis, has shown that AMI has positive effects among mothers to improve children's oral health and as well as in other oral health settings (Freudenthal and Bowen, 2010). AMI has not been used in oral hygiene interventions among adults, although Jönsson and colleagues (2010) found a tailored oral health education intervention among patients with periodontitis gave the tailored group patients better clinical outcomes than the control group and greater confidence in their ability to maintain oral hygiene behaviors.

In our model, the individual level intervention was implemented using adapted motivational interviewing and oral hygiene skills practice to mastery (AMI-PM). The AMI was tailored to each participant, based on 12 domains derived from the IM plus activities of daily living, self-reported oral health behaviors and symptoms of dry mouth. A survey provided the basis for identifying participants' cognitive and behavioral competencies by establishing cut-offs for each domain as well as providing data for pre-post intervention comparisons in these domains. Cut-offs for each domain were established through an iterative process based on discussion among the research team members. The goal was to identify conceptual areas where individuals had gaps in physical abilities, oral health symptoms, beliefs and behaviors about that would limit their ability to perform oral hygiene behaviors. The domains are described below. The oral hygiene skills enhancement component involved guided instruction and participant practice of correct brushing of teeth and flossing. Baseline clinical assessments of plaque and gingival scores were conducted and the results shared with intervention participants to guide their brushing and flossing practice.

Talking points in English and Spanish were developed for each of the domains. Interventionists focused each participant's intervention on the domains that were below the cutoff point by engaging the participant in a dialogue about each domain, and using the domain-related talking points to address participants' domain-related concerns or gaps. The interventionists also worked with participants on practicing brushing and flossing skills on a typodont, a clinical model of teeth and gums. Prior to counseling and modeling, participants were asked to demonstrate their brushing and flossing skills on the typodont and were rated for each on a 4-point scale (poor, 1; fair, 2; good, 3; excellent, 4). Subsequently they were shown the results of their baseline assessment, were shown short videos on correct brushing and flossing techniques. They then practiced until they achieved their best result, and were rated again by the interventionist.

There is a growing literature on the effectiveness of community-run campaigns based on principles of community-based participatory research that focus on specific health problems (Reininger *et al.*, 2010; Schensul and Trickett, 2009), some using a multilevel approach (Schensul *et al.*, 2009). The development and implementation of campaigns always include members of the population to which the activities are directed, thus ensuring cultural responsiveness and the social influence of peers or public personalities as role models. Our previous work in the context of low income senior housing has demonstrated the effectiveness of this bi-level approach (Schensul *et al.*, 2009).

A volunteer campaign committee recruited at the building organized the campaign events with the support of study personnel. Five volunteers were recruited from the building and participated in training sessions facilitated by study staff to plan the events, develop activities and create oral health messages. These sessions were conducted in English and Spanish. The committee generated core messages and with help from staff, related the messages to the domains in the IM conceptual model. All domains in the conceptual model were covered by the messages. Two campaign events were conducted in the study building approximately one month apart. Each campaign event lasted about three hours and was framed around the delivery of the oral health messages and information about oral health. Each event included oral health information booths staffed by residents, a question and answer session with a dental provider, a Practice to Mastery (PM) table staffed by building residents and a dentist, a poster contest using campaign messages, and pro-oral health games. Fifty-five residents attended in total with approximately 65% overlap across both campaign events.

Clinical assessments were completed prior to the AMI-PM and campaigns and three months post campaigns. The Gingival Index (GI) (Löe and Silness, 1963) was used to assess the presence of gingival inflammation around six surfaces of each tooth. The GI was described as: 0, no visual signs of inflammation; 1, slight change in color and texture of the gingiva but no bleeding; 2, visual sign of inflammation and bleeding upon swiping; 3, overt inflammation and spontaneous bleeding. Mean GI was calculated per participant.

We used the O'Leary plaque control record (1972), which was developed as a dichotomous measure for plaque on the gingival third of each tooth surface. The supragingival bacterial plaque was assessed with the use of erythrosine disclosing solution on six surfaces of each tooth and calculated based on the number of surfaces stained positive for plaque divided by the total number of surfaces.

Participants first received a soft tissue exam, evaluation of existing prostheses and the presence or absence of teeth. This was followed by the gingival assessment and then the plaque index. Universal precautions were observed and disposable instruments were removed via sharps containers. The clinical assessment took about 15 minutes to complete. Dentists doing the evaluations were instructed to not give any advice or input regarding participants questions about oral hygiene. The examiners provided the interventionists with the exam form showing plaque sites in red. This was used as an effective teaching tool during the AMI sessions.

One licensed dentist and two residents from the Advance Education in General Dentistry program conducted the clinical assessments. Initial training sessions took place at the School of Dental Medicine to orient examiners to the population under study, diagnostic criteria and examination methods. The three clinical examiners were calibrated using an American Academy of Periodontology Board certified periodontist faculty member as the gold standard. Two volunteers at the UCHC dental clinics were included for the calibration of the plaque index and gingival indices as the baseline assessment and were recalibrated prior to the follow-up dental exams of participants. Different quadrants were selected for calibration in each person. The total number of surfaces examined was 234 for intra- and inter-examiner agreement and reliability. Inter- and intra-examiner agree-

ment was assessed by calculating the Kappa statistic. Kappa was 0.54 at the baseline and 0.73 prior to the follow-up.

The survey was administered in English or Spanish, face to face by members of the research team. Data were collected at baseline and three months after the campaigns on each of the following twelve cognitive variables.

1. Activities of Daily Living (ADL index): a widely used measure of the functional status of an individual. The scale consists of eight behaviors that indicate ability to take care of basic personal needs (Katz, 1983; Lawton and Brody, 1969). The cut-off was based on needing help on grooming, dressing, eating, brushing or teeth/cleaning dentures.
2. Oral Health Knowledge: a seven-item true/false test based on previously developed test used with low income older African Americans (Slaughter and Evans, 2007). The cut off was a score below 5.
3. Oral Health Beliefs – Self-Efficacy and Locus of Control: The Dental Coping Beliefs Scale (Wolfe *et al.*, 1996) is a 26-item scale consisting of four subscales, oral health beliefs, internal locus of control, external locus of control, and self-efficacy. The scales were adapted in the pilot study and used to measure locus of control and self-efficacy, two key domains in the study model (α 0.60). The cut-off was a mean response of strongly/partly disagree on the self-efficacy scale and agreement with the statement “You believe tooth loss is a normal part of growing old.”
4. Oral Health Norms: a five-item scale assessing the perceived importance of visiting the dentist once a year, brushing your teeth at least once a day, brush with fluoride toothpaste, flossing or cleaning between teeth at least once a day, checking for sores in the mouth (α 0.57). The cut-off was a response of “not at all important” on any item.
5. Oral Health Social Support: measured with one item: “Who do you go to for health information in this building?” A response of “no one” was considered a problem.
6. Oral Hygiene Behaviors: This behavior was assessed by self-report of frequency of brushing. Responses of less than twice a day were considered a problem.
7. Perceived Oral Health Risks: a five-item scale assessing perceived risk of oral health problems, including getting cavities, toothaches, gum problems, oral cancer and oral health problems that would cause a visit to the hospital. Participants rate the likelihood of having these problems on a four-point scale, 1 (very unlikely) to 4 (very likely), (α 0.84) The cut-off being a mean score of likely/very likely.
- 8&9. Oral Health Self-Management Fears and Worries: These domains investigated the effects of self-management fears and worries on oral hygiene behaviors. Two scales were developed from formative data collected through our prior studies and evaluated during the pilot. The scales consisted of items identified by residents in focus group sessions related to worries and fears about conducting oral hygiene behaviors. Dental Worries Scale - 23 items (α 0.90); Dental Fears - 4 items (α 0.75). These were considered problems if the mean score were “somewhat/very worried or fearful,.

10. Oral Health Self-Management Intentionality: This critical component of the IM model, was assessed using the protocol described by Tedesco and colleagues (1991) and adapted based on formative data. Participants rated their intention to brush and floss daily using a five-item four-point scale (α 0.81). The cut-off was a mean score of “no possibility/slight possibility”.
11. Dry Mouth: an eight-item self-report measure on symptoms of dry mouth developed by Fox and colleagues (1987).
12. Diet: Sugar intake was assessed with a five-item scale on frequency of eating cakes, candies and sugary drinks. This was identified as a problem if frequency was more than four times a day on any item.

The analysis is primarily descriptive presenting frequency distributions, means and standard deviations of the descriptive characteristics of the sample, scores on the domains of the AMI-PM and the plaque and gingival scores. Changes from pre to post-interventions were assessed using non-parametric statistics, including Chi Square and the Wilcoxon test.

Results

Thirty-four individuals enrolled in the intervention, and 27 with at least one tooth completed the clinical assessment and the pre-post survey. Table 1 presents the descriptive characteristics of the sample. Participants' ages ranged from 49 to 74 with more than half being under 60 years of age with all those aged under 62 having a disability. Most were female and Hispanic. The participants had low levels of formal education with less than half completing high school. The mean monthly income was US\$790 (SD \$268). Most participants had visited the dentist within the past six months and perceived their oral health as fair or poor. The majority of participants reported brushing their teeth twice or more a day. Symptoms of dry mouth seemed to be a problem as indicated by an average of three or more symptoms. Participants seemed to be fairly knowledgeable about dental matters, as the mean score on the dental knowledge test was five of seven correct. The people living in the building were independent but limitations in daily living activities were substantial as 53% had one or more limitations in ADLs.

Table 2 presents the twelve domains and the percentages of participants needing help in each domain. The mean number of domains requiring attention was 4.5 (SD 1.6) with a range of one to seven problem areas. Highly problematic areas (>50% of participants scoring beneath the cutoff point) were ADLs, self-management concerns and worries, and self-management fears; less frequently identified areas (20-50%) of participants scoring beneath the cutoff point) were oral health self-efficacy, locus of control, social support, oral hygiene behaviors, dry mouth and diet.

Participants demonstrated a significant improvement in the Plaque Score from 82.7% (SD 16%) at baseline which improved significantly to 57.5% (SD 31.0%); mean baseline GI was 1.15 (SD 0.61) and improved significantly to 0.49 (SD 0.46).

Table 1. Descriptive characteristics of the participants at baseline (n=34)

<i>Variable</i>	<i>Mean (SD)</i>	<i>%</i>
Age	59.4 (8.9)	
≤50 years		15
51-59 years		41
60+ years		44
% Female		71
Race/Ethnicity		
African American		15
Puerto Rican		62
White		18
Other		6
Education		
≤8 years		53
9-11 years		6
12 years		21
>12 years		21
Marital Status		
Single/Unmarried		21
Married		18
Separated, Widow, Divorced		62
Total monthly income in US\$	790 (268)	
≤700		29
700-899		35
900+		35
Years lived in the building	7.1 (6.1)	
Time since last dental visit		
>2 years		24
1 to 2 years		21
6 months to 1 year		18
Last 6 months		38
Brushing frequency		
≤ Once/day		29
≥ Twice/day		71
Dry mouth symptoms (0-7)	3.3 (1.8)	
Dental knowledge score (0-7)	5.3 (1.1)	
<5		21
Self-rating of oral health		
Poor		35
Fair		26
Good		29
Excellent		8.8
Number of ADLs needing help (0-8)	3.6 (3.7)	
0		47
1-7		19
8		34

Table 2. The twelve domains and the percentages of participants needing help in each domain

Domain	% with problem
1. Activities of Daily Living	53
2. Oral health knowledge	21
3. Oral health beliefs: a. Self-efficacy	21
b. Locus of control	41
4. Oral health norms	24
5. Oral health social support	35
6. Oral hygiene behaviors	29
7. Perceived oral health risks	24
8. Self-management worries	65
9. Self-management fears	82
10. Oral health self-management intentionality	15
11. Dry mouth	38
12. Diet	23

Non-parametric analyses of changes in cognitive measures from baseline to follow-up were conducted using the Wilcoxon test. There was significant improvement in the self-management fears scale from 2.2 to 1.8 ($p < 0.05$). There were no other significant changes although all scales showed some improvement. Despite the sample size, differences in PM skills scores ($n=20$) from pre- to post-instruction in brushing and flossing showed significant improvement: from 1.9 (fair/poor) to 2.9 (good/excellent) and from 1.7 to 2.7 respectively (both $p < 0.001$).

Discussion

The pilot study we have described demonstrated feasibility, acceptability and efficacy of a bi-level community-based intervention to improve oral hygiene among independently living low income older and disabled adults. Data from the pilot indicate the feasibility and high degree of acceptability of a theoretically driven cognitive intervention with a behavioral practice component tailored to individual participant needs based on survey responses to domains derived from Fishbein's model and Bandura's concepts of self-efficacy and practice to mastery. Our measures had good reliability and were acceptable to both our English and Spanish speaking participants, many of whom had limited formal education. Preliminary data on the clinical assessments provide evidence that the AMI-PM individual level intervention combined with building level campaigns were effective in improving oral hygiene of the participants. Despite the small sample size, there were substantial and significant improvements in the gingival index and plaque scores which, would, if sustained, lead to better oral health over the long term.

Several commentators have discussed the importance of providing services "in place" (Lamster *et al.*, 2008). Conducting interventions in places of residence of older and disabled adults allows individuals to feel secure in their own environment and draws on the additional resources available from management and other residents.

The pilot study showed the feasibility and acceptability of delivering tailored oral health interventions to individuals in senior housing as well as involving local residents in the creation and delivery of local, building level campaign (health fair) events. Residents took leadership in the building community, and were able to generate oral health events that included messages important to participants that were linked to the conceptual domains of the IM/Bandura model. The campaign events also engaged larger numbers of people, reinforced the messages in individual-level intervention and by engaging building residents in delivery, should contribute to greater sustainability in the future.

The effects of the individual AMI-PM could not be separated from the campaign and the sample size did not permit additional analysis of mediating or moderating effects proposed in the conceptual model. A larger multi-site study is currently being implemented to evaluate the independent and synergistic effects of the bi-level intervention and to investigate the mediating and moderating effects of the conceptual domains to better understand the underlying behavioral mechanisms accounting for better oral health status.

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