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Cost-minimization analysis of a tailored oral health intervention designed for immigrant older adults

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Aim: This paper presents an economic evaluation, from a societal viewpoint, comparing a community-based oral health promotion program aimed at improving the gingival health of immigrant older adults, with one-on-one chairside oral hygiene instructions at a public dental clinic in Melbourne, Australia.

Methods: The costs associated with implementing and operating the oral health promotion program were identified and measured using 2008 prices. The intervention was based on the Oral Health Information Seminars/Sheets model, and consisted of 10 20-min oral hygiene group seminars and four 10-min supervised individual brushing sessions carried out by a non-oral health professional educator. Health outcomes were measured as a reduction in gingival bleeding. Clinical data showed a 75% reduction in mean gingival bleeding scores among those who took part in the intervention. A population of 100 active, independent-living older adults living in Melbourne, and members of Italian social clubs, was used for modeling in this analysis.

Results: This analysis estimated that if an oral hygiene program using the Oral Health Information Seminars/Sheets model was available to 100 older adults, the net cost from a societal perspective would be AUD\$6965.20. In comparison, a standard individual oral hygiene instruction program, at public dental clinics, given equivalent levels of case complexity and assuming the same level of effectiveness, would cost AUD\$40 185.00. Per participant cost of a community-based oral health promotion program was \$69.65 versus \$401.85 for chairside instruction.

Conclusions: Findings confirm that community-based oral health interventions are highly cost-effective and an efficient use of society's financial resources. **Geriatr Gerontol Int 2014; 14: 336–340.**

Keywords: cost-minimization, elderly, emigrants and immigrants, health promotion, oral health.

Introduction

Improvements in oral health in Australia over the past 50 years have translated into a greater number of older people retaining more teeth, increasing the likelihood of both coronal and root caries, and periodontal disease in these age groups. These oral diseases place a considerable burden on individuals, families and the community. Gum (periodontal) disease, for example, is the fifth most prevalent health problem.¹ It is possible for oral bacteria to enter the bloodstream, which can cause systemic problems, especially for people without a healthy immune system.² A range of health conditions associ-

ated with periodontal infection can also have an adverse effect on glycemic control and the incidence of diabetes complications.³

The two most common gum diseases are gingivitis and periodontitis. Gingivitis is a reversible inflammation of the gum tissue, characterized by redness, swelling and bleeding. Periodontitis is the chronic, non-reversible destruction of the soft tissues and bones that support the teeth. In advanced periodontitis, teeth can become loose and need to be extracted. However, periodontal health can be maintained successfully with adequate oral hygiene, and periodontal therapy and maintenance.^{4–6} Despite these factors, coordinated oral health promotion programs designed to improve the oral health status of this section of the population are almost non-existent in the Australian state of Victoria.

A culturally appropriate, community-based oral health promotion program was designed for Italian older adults living in Melbourne, Australia. The program, known as Oral Health Information Seminars/Sheets (ORHIS), consisted of 10 interactive oral health

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seminars, with the provision of oral health information sheets and oral care products relevant to each oral health seminar topic.⁷ The ORHIS aim was to improve the oral health knowledge, attitudes and behavior of older adults, as well as the oral health status and use of services.^{7,8} The program was offered through community ethnic clubs with known high participation rates and delivered by lay health workers (LHW). A LHW is a member of the community who has received some training to promote health or to carry out a listed number of healthcare services, but is not a healthcare professional.⁹ Their use is well established in the literature as less expensive, and fostering self-reliance and local participation.^{9,10}

The evaluation of the ORHIS approach showed that, compared with participants in the control group, intervention group participants showed statistically significant improvements in oral health knowledge, attitudes⁸ and clinically assessed gingival health status.⁷ However, an outcome evaluation provides only limited information to health planners and policy makers about the implementation of health promotion programs.¹¹

An economic evaluation of an oral health promotion program would yield data and a model on cost-effectiveness that would be of extreme value to agencies considering the implementation of oral health promotion programs to improve gingival health of older adults.¹² Thus, to obtain more comprehensive information about this community-based oral health promotion program, the present study reports on an economic evaluation, from a societal perspective, comparing the cost and benefits of a tailored community-based oral health promotion program aimed at improving the gingival health of culturally and linguistically diverse older adults, with an alternative program utilizing non-tailored one-on-one chairside oral hygiene instructions at a public dental clinic in Melbourne, Australia.

Methods

The form of economic evaluation (EE) used in the present study was cost-minimization analysis (CMA). CMA is a special type of cost-effectiveness analysis (CEA) where the two programs being compared do not differ in their effectiveness.¹³ CMA is focused on finding the cheapest way to provide a program or intervention. Thus, at its simplest, CMA is value-for-money. As delineated in Figure 1, in CEA, costs of alternative programs are measured as economic costs and outcomes are valued in units of effectiveness (gingival health).¹³ Improvements in gingival health (i.e. reduction of gingival bleeding) were assumed to be the same under both modalities. That is, both modalities had equivalent results (no statistical differences) in terms of oral hygiene and clinical effectiveness.

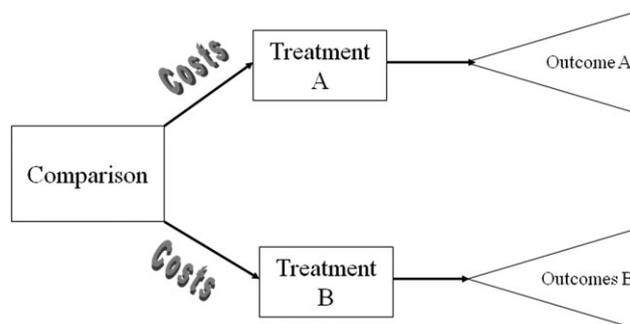


Figure 1 Components of economic evaluation.

Intervention

The community-based oral health promotion program, ORHIS,⁸ consisted of four components: (i) 10 20-min oral health seminars of oral hygiene education, repeated after a fortnight to groups of six to seven older adults, carried out by a LHW who did not have an oral health professional background; (ii) provision of the oral health information sheets; (iii) the LHW also acted as a peer-educator and carried out four 10-min, one-to-one oral hygiene sessions at the club premises demonstrating tooth brushing and dental flossing (together with feedback on performance); and (iv) provision of relevant oral health products. The one-on-one oral hygiene sessions included the review of brushing technique, use of dental plaque disclosing tablets, instructions on dental flossing technique and denture cleaning.

A total of 183 participants, 100 in the control group and 83 in the test group, completed the intervention scheme and had complete clinical data. They were members of 11 Italian social clubs. The mean age of the final sample was 72.4 years (SD 6.8), with 52.2% aged between 65 and 74 years. The majority were female (55.6%), had completed primary education (67.4%), including 20.6% with at least some secondary education. The majority lived with their spouses (66.8%). Participants were allocated to either the control or the test group. No periodontal treatment was provided. Two clinical measures were assessed at baseline and at follow up; the Plaque Index of Silness and L  e¹⁴ and the L  e and Silness Gingival Index.¹⁵ This evaluation took place between July and October 2008.

Costs

Using a societal perspective, data from the community-based oral health promotion, together with all the costs of running the program, were used to determine program cost-effectiveness when compared with the chairside (*status quo*) alternative. All the relevant costs of the intervention, at its different phases, were identified and accounted for using 2008 prices. The shared costs were apportioned appropriately.

Personnel requirements to run the program included the cost of the LHW. The LHW was paid at University of Melbourne levels as a research assistant. This included the cost of time spent by the LHW traveling to and from the social clubs. The cost of travel to the social clubs' health center was calculated at the Australian Taxation Office's allowance by kilometer. The consumable costs, that is, the costs of oral hygiene products distributed as part of the program, were calculated at market prices.

To estimate the incremental cost-effectiveness ratio, a group of 100 active, independent-living older adults living in Melbourne, all members of Italian social clubs, was used in the study.

Comparator

A comparison group was formed by an equivalent population of 100 active, independent-living older adults living in Melbourne, all members of Italian social clubs who would attend two 20-min sessions of dental education, and four one-to-one, 8-min chair-side oral hygiene sessions carried out by a dental hygienist at the Royal Dental Hospital of Melbourne (RDHM) working for Dental Health Services Victoria. Such a program would therefore take 72 min per 100 patients (at \$44.65 per 8-min session). The sessions also included distribution of oral hygiene products (tooth brush, floss, toothpaste, etc.) at no cost to the patient.

Effectiveness

Health outcomes were measured as a reduction in gingival bleeding. The clinical outcome of the ORHIS program showed that older adults who completed the intervention scheme, after controlling for pretest scores, presented a significant 75% reduction in their levels of gingival bleeding (GI 0.44 *vs* 0.11).⁷

Results

The estimated cost of oral hygiene instruction over the 6 weeks for the intervention program for 100 active, independent-living older adults is presented in Table 1. Our analysis estimated that if an oral hygiene program using the ORHIS model was available to 100 older adults, the net cost from a societal perspective would total AUD\$6965.20 (USD\$1 = AUD\$0.86 in 2008). In comparison, a standard individual oral hygiene instruction program, at the RDHM, given equivalent levels of case complexity and assuming the same level of effectiveness, would total AUD\$40 185.00 (nine 8-min sessions at \$44.65, for each 8-min session, per 100

Table 1 Summary of total costs associated with oral health promotion program

Cost category	Amount (AUD\$ in 2008) [†]
Salaries	
Oral Health Educator (73.3 h @ \$28/h) [‡]	\$2052.40
Oral Health Educator Training, debriefings (12 h @ \$28/h)	\$336.00
Rent	\$1268.80
Travel expenses (40 trips of 20 km @ \$0.71/km)	\$560.00
Program consumables	
Super floss	\$120.00
Toothbrush	\$394.00
Interdental brush	\$370.00
Disclosing tablets	\$720.00
Professional brush	\$109.00
Toothpaste	\$395.00
Dental ribbon	\$154.00
Bags	\$25.00
Printing material (100 folders @ \$4.55 per folder)	\$455.00
TOTAL	\$6965.20

[†]USD\$1 = AUD\$0.86 (in 2008). [‡]Ten 20-min oral health seminars repeated after a fortnight, plus four 10-min toothbrushing sessions per 100 patients = 4400 min (i.e. 73.3 h).

Table 2 Summary of total costs associated with oral hygiene program at a public dental clinic in Melbourne, Australia

Cost category	Amount (AUD\$ in 2008) [†]
900 dental hygiene sessions [‡] (@ \$44.65, for each 8-min session, per 100 patients)	\$40 185.00

[†]USD\$1 = AUD\$0.86 in 2008. [‡]Four 8-min toothbrushing sessions plus two dental education sessions of 20 min = Nine 8-min sessions.

patients). A summary of costs for the chairside oral hygiene instruction is listed in Table 2.

The per participant cost of a community-based oral health promotion was \$69.65 versus \$401.85 for chair-side oral hygiene instruction session. That is, oral hygiene instruction costs were approximately 82% higher in the control group. Thus, this program resulted in a societal saving of, at least, AUD(2008)\$332.20 per-cycle per person in favor of group-based interventions.

Discussion

Evidence showed that the ORHIS program implemented through the network of social clubs was effective in terms of improving gingival health.⁷ In addition, this EE confirms that this community-based oral health promotion to improve and maintain gingival health by a LHW is highly cost-effective and an efficient use of society's financial resources. Such a model would be less expensive than using conventional one-to-one chairside oral hygiene instruction provided by dental hygienist working in a public dental clinic in Melbourne, Australia.

Developing cost-effective and easily implemented strategies to enhance oral health among older adults is of great public health relevance, in particular, in a continuing climate of limited resources available for dental care and workforce shortages. Mariño *et al.* noted that the costs of implementation of preventive measures vary significantly, depending on the type of staff operating the procedures.¹⁶ The substitution of dental hygienist by LHW is an example. Because staff have a heavy load in the cost of a preventive program, these results are important for policy decisions, as they enable comparisons between chairside interventions, using oral health professionals (e.g. dental hygienists), and community-based interventions using LHW. The finding that a non-oral health professional will produce a cheaper outcome is obvious.¹⁰ However, it is not trivial when considering a differential return to investment, and the implications for local outreach and treatment of older populations. LHW can improve the cost-effectiveness of the healthcare system by reaching a large number of previously under-served people with high-impact basic services at a low cost.

For the purpose of the present study, a number of simplifying assumptions were made. It is not unusual to use assumptions when carrying out EE.¹⁷ However, their use tends to underestimate the cost of a program.¹⁸ There are a number of non-health benefits with the ORHIS approach, such as process of care, the information resulting from the intervention, its cultural appropriateness, and the degree of empowerment in the treatment process¹⁹ and social capital outcomes, which were not considered in the present analysis. Additionally, although not evaluated in this effort, older Italians indicated the value of this approach.²⁰ These are important outcomes in public health as, sustainability, or the ability of the project to meet the needs of the community beyond the period of the study, depends on support and input from the community.¹⁹ There were also some cost savings to patients, as they did not need to travel to the public clinics (i.e. Royal Dental Hospital of Melbourne).

Intangible benefits were also not quantified, but were assumed not to be non-existent.²¹ These issues are more

complex, but not outside the realm of EE;²² however, they are difficult to assess within the constraints of a research framework, and probably go beyond the intervention itself. Thus, there might be an underestimation of savings. However, although the current analysis was hypothetical in some areas, in others it was based on existing data. For example, costs for the comparator intervention were based on actual cost from the Dental Health Services Victoria and University of Melbourne rates for professional staff (i.e. research assistants).

Although we acknowledge these assumptions, the purpose was to show the cost per unit of health gained from the different programs under a particular situation. The study indicates that group-based interventions to manage gingival health by a peer-educator would be less expensive than chairside oral health instruction provided by oral health professionals working at the RDHM. As such, findings confirm that community-based oral health interventions are highly cost-effective and an efficient use of society's financial resources. This evaluation adds valuable information to the diverse stakeholders, particularly, in the context of shortages of oral health professionals and economic constraints.

Further research on the cost and cost-effectiveness of oral health prevention programs is warranted to improve the cost-effectiveness of the model. In the future, a more holistic approach could better capture the many aspects of this community approach, and in so doing make this intervention more cost-effective, or better value-for-money.

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Disclosure statement

The authors declare no conflict of interest.

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