

Health economic analyses of domiciliary dental care and care at fixed clinics for elderly nursing home residents in Sweden

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Objectives: Dental care for elderly nursing home residents is traditionally provided at fixed dental clinics, but domiciliary dental care is an emerging alternative. Longer life expectancy accompanied with increased morbidity, and hospitalisation or dependence on the care of others will contribute to a risk for rapid deterioration of oral health so alternative methods for delivering oral health care to vulnerable individuals for whom access to fixed dental clinics is an obstacle should be considered. The aim was to analyse health economic consequences of domiciliary dental care for elderly nursing home residents in Sweden, compared to dentistry at a fixed clinic. **Methods:** A review of relevant literature was undertaken complemented by interviews with nursing home staff, officials at county councils, and academic experts in geriatric dentistry. Domiciliary dental care and fixed clinic care were compared in cost analyses and cost-effectiveness analyses. **Results:** The mean societal cost of domiciliary dental care for elderly nursing home residents was lower than dental care at a fixed clinic, and it was also considered cost-effective. Lower cost of dental care at a fixed dental clinic was only achieved in a scenario where dental care could not be completed in a domiciliary setting. **Conclusions:** Domiciliary dental care for elderly nursing home residents has a lower societal cost and is cost-effective compared to dental care at fixed clinics. To meet current and predicted need for oral health care in the ageing population alternative methods to deliver dental care should be available.

Key words: aged, dentistry, domiciliary care, geriatric dentistry, health care economics and organizations, home care services, nursing homes, Sweden

Introduction

The elderly population in Sweden is increasing in numbers and life expectancy is prolonged (Lundqvist, 2013). Improved dental status in the adult population, as also seen in large parts of the world, has led to a situation with a majority of the elderly retain most of their own teeth relatively intact, often in combination with dental restorations or prosthetics (e.g. crowns, bridges, dental implants) (Petersen *et al.*, 2012). Thus, the cost of dental care for the elderly population is expected to increase substantially during the next decades (Petersen *et al.*, 2012). Ageing often leads to increased morbidity, and hospitalisation or dependence on the care of others, all of which contribute to a risk for rapid deterioration of oral health (Terezakis *et al.*, 2011). County councils in Sweden subsidise dental care for elderly nursing home residents, and elderly nursing home residents are entitled to limited dental care, for the same fixed patient fee as in outpatient health care (Tandvårdslagen, 1998), with a yearly maximum of €125 (€1=SEK8.80 at October 2013). Among those so entitled are the frail elderly with comprehensive need for personal assistance, people with mental or functional limitations, and those receiving advanced medical home care. The patient is free to choose provider of dental care, and traditionally dental care is offered at fixed dental clinics, though domiciliary dental care has emerged as an alternative (Komulainen *et al.*, 2012; Sjögren *et al.*, 2010).

Prioritising within health- and dental care is necessary due to limited resources. Health economic analyses can be used as a tool to support the decision makers in this process. To our knowledge there are no previously published health economic analyses of domiciliary dental care for elderly. Therefore the aim was to analyse economic consequences providing domiciliary dental care for elderly nursing home residents in Sweden, compared to dentistry at a fixed clinic.

Methods

There was an initial review of relevant literature. To complement the literature review interviews were conducted with nursing home staff (n=5), county council officials (n=2) and academic experts in geriatric dentistry (n=3) to obtain a wide picture of the dental care situation for elderly nursing home residents. The nursing homes for this study were selected at various distances from major urban areas, covering both private and public (municipal) ownership. Interview data were used for descriptive and hypothesis generating purposes, and statistical inference was not attempted.

Based on the findings in the review and the interviews, key aspects were identified, that could influence the choice of either domiciliary dental care or dental care at a fixed clinic. The identified aspects were also analysed in relation to the British Society for Disability and Oral

Health decision support model (All Wales Special Interest Group, 2006), which has been recommended for use by some of the Swedish County Councils.

In-depth health economic analyses were conducted, initially with cost analyses comparing the costs of a visit to a fixed clinic with the costs of domiciliary dental care and thereafter with cost effectiveness analyses. The cost analyses were based on three scenarios: a basic analysis, and two sensitivity analyses, covering the cost variations of ‘best case scenarios’ for both domiciliary dental care, and dental care at a fixed clinic. The dental care fees were obtained from the Dental Commissioning Unit, County Council of Östergötland, Sweden. The estimated mean cost per dental treatment, which was used in the calculations, was based on the average cost per patient, per year, in the County of Östergötland. Although, the true cost per dental appointment was estimated to be lower, since some of the patients received dental care more than once per year, it did not affect the relative cost differences and furthermore it was adjusted for in the sensitivity analysis. The exchange rate of 8.80SEK/€ (October 2013) was used to render all comparisons in Euros.

Cost analyses were calculated with the opportunity costs for each dental care appointment. For example, the cost of an accompanying nursing home staff member was calculated as the salary plus social security charges and other expenses (i.e. the mean salary of a nurse: €2,773 per month, plus 45% social security charges, working 160 hours per month, totalling to €25.2 per hour). The mean salary was obtained from Statistics Sweden (SCB) (Statistics Sweden, 2013). When calculating the costs of community-based transportation service, the mean cost in the County of Östergötland was used, based on statistics from SCB (Trafikanalys, 2012).

Cost-effectiveness analyses were conducted by setting the data obtained from the cost analyses in relation to the anticipated effects of dental care on the quality of life. Quantitative effects of quality of life were not available, but the anticipated impact on quality of life of the different forms of dental care was modelled in three scenarios in cost-effectiveness planes.

To gain a deeper understanding of how this particular dental market segment works, important incentives that theoretically could influence the choice of dental care form for the different stakeholders (i.e. patients, providers of dental care, county councils, and nursing homes) were identified and analysed.

To reduce the risk of suboptimal interpretations the costs were analysed in an overall budget impact analysis. The impact of the dental care form on the budget of the different market stakeholders was analysed to evaluate benefits and consequences at the community level.

Results

Based on the findings from the literature review and the interviews eight patient centred aspects were identified that were considered important for the choice of the dental care form, i.e. domiciliary or fixed clinic. The aspects of importance were; direct costs, indirect costs/relatives, freedom to choose, quality of the treatment, prerequisites of the patient, quality of life, staff and administration and legal aspects. The different aspects

interact with each other and should not be analysed in isolation. All the identified aspects are furthermore connected to ethical concerns that need to be considered (e.g. respecting patients’ autonomy, integrity and their rights to receive dental care).

Cost analyses

The mean cost of necessary dental care for the County council of Östergötland was €624.3 per patient per year. According to the interviews, a nursing home staff member usually accompanied the elderly nursing home resident to the fixed clinic. The total time required for a visit at the dental clinic was approximately three hours, including transportation service, waiting time, and active treatment time. Hence, the absolute estimated cost of an accompanying person was €75.6, i.e. €25.2 x 3hrs. In domiciliary dental care the effort for nursing home staff was deemed very low, and the cost of nursing home staff was estimated to €11.4, including certain preparation before, and minor assistance after the treatment. In theory, an informal caregiver accompanying the elderly to the fixed clinic could have replaced the staff, but the interviews revealed that this was not often the case.

Within community based transportation, in the County of Östergötland, a total of 719,077 one-way trips were made with the transportation service, and 2,244 one-way trips with national transportation (Trafikanalys, 2012). The total cost of transportation service was €18.8 million. The cost of the transportation service varied with the distance to the fixed clinic, but the mean cost was estimated at €52.0 including return trip.

The total cost of a domiciliary dental care appointment was €116.3, or 15% lower than the appointment at a fixed dental clinic (Table 1).

Table 1. Cost analysis, base case, comparing dental care at fixed clinic with domiciliary dental care

Cost per visit	Form of dental care	
	Fixed clinic €	Domiciliary €
Reimbursement (average)	624	624
Nursing home staff	76	11
Travel cost	52	0
Relatives	0	0
Total:	752	635

Note each cost displayed is rounded to the nearest integer

Sensitivity analysis, based on a best-case scenario for dental care at fixed clinic, assumed that all treatments could not be finished in a domiciliary setting, and sometimes an additional appointment at a fixed clinic was needed. The additional visit at a fixed clinic was estimated to increase the cost of domiciliary dental care by 10%. Under these conditions, the cost of domiciliary dental care was €39.7, or 6% higher than to dental care at a fixed clinic (Table 2).

Another sensitivity analysis, based on a best-case scenario for domiciliary dental care, assumed that no assistance was needed from the nursing home staff so reducing the cost of domiciliary dental care by an ad-

Table 2. Cost analysis, best case for fixed clinic, comparing dental care at fixed clinic with domiciliary dental care

Cost per visit	Form of dental care	
	Fixed clinic €	Domiciliary €
Reimbursement (average)	624	686
Nursing home staff	11	11
Travel cost	11	0
Relatives	11	0
Total:	657	697

Table 3. Cost analysis, best case case for domiciliary dental care, comparing dental care at fixed clinic with domiciliary dental care

Cost per visit	Form of dental care	
	Fixed clinic €	Domiciliary €
Reimbursement (average)	416	416
Nursing home staff	76	0
Travel cost	52	0
Relatives	0	0
Total:	544	416

ditional €11.4 per appointment. In addition, since the annual cost of dental care per patient for the County Council in Östergötland (€624.3) was deemed too high (some of the patients have had several dental appointments), the cost of dental care was set at €416.25, which was equivalent 1.5 appointments per patient per year. In absolute terms, this assumption did not affect the cost difference between domiciliary dental care and fixed clinic, but the total cost of domiciliary dental care was €127.6, or 23%, lower than the cost of dental care at a fixed dental clinic (Table 3).

Cost-effectiveness

The cost effectiveness of domiciliary dental care are analysed and illustrated using a cost-effectiveness plane, see Figure 1. In the first model, the effect on quality of life was assumed to be similar for domiciliary dental care and dental care at a fixed clinic, as long as the individual was free to choose. Since the cost of domiciliary dental care was lower (as in the base case presented above), domiciliary dental care was cost effective compared to dental care at a fixed clinic (marked A in Figure 1).

In the second model, domiciliary dental care was considered to improve the quality of life for elderly nursing home residents. Based on the fact that these individuals often have difficulties with transportation to a fixed dental clinic, domiciliary dental care was expected to improve the quality of life. In the cost-effectiveness plane both costs and effects were in favour for domiciliary dental care, and domiciliary dental care was dominant (marked B in Figure 1).

The third model, displayed a situation where the patient could easily be transported to a fixed clinic. In this case, dental care at a fixed clinic was considered to lead to a somewhat better effect on the quality of life than domiciliary dental care. This assumption was obvious for advanced procedures that could not be performed in a

domiciliary setting. In this scenario, domiciliary dental care contributed to a lower cost with a lower impact on the quality of life, compared to dentistry at a fixed clinic (marked C in Figure 1). This scenario required a threshold value for what is considered to be cost effective, but such a value has not been established in this context.

Budget impact

The budget impact analysis revealed that domiciliary dental care had no direct impact on the county council's expenses, which solely consisted of the reimbursements to the dental care providers, and were similar for both settings. However, if the treatment was not possible to complete in a domiciliary setting, and a revisit at a fixed clinic was needed, the county council's expenses would have increased. For the municipalities, the choice of dental care form was more important from a cost perspective. The costs for the municipalities were expected to decrease with domiciliary dental care, since the cost of transportation services was eliminated. Domiciliary dental care also reduced the cost for the nursing homes when accompanying staff were not needed during the dental appointments.

Incentives

Several incentives were identified that could lead the different stakeholders in the geriatric dental care market (i.e. patients, providers of dental care, county councils, and nursing homes) to influence the patients choice of dental care form. These incentives had such potential importance that they need to be considered and controlled to prevent suboptimal behaviour from being realised. No such behaviours could be noted in this study.

The patient has a legal right to choose the dental care provider, but asymmetric information from other stakeholders may influence the patients. Thus, the barriers set by market stakeholders could jeopardise patients' rights. In addition, individuals in the geriatric patient group may have difficulties in making informed choices. The various health care providers had an incentive to tie the patient to them through the procured domiciliary dentistry service. This procured access to the nursing home resident patients was considered an important link for

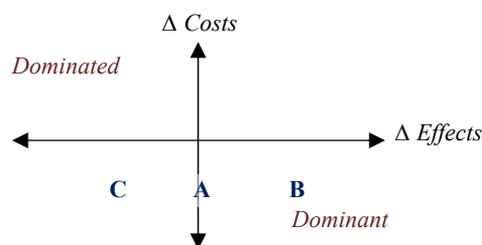


Figure 1. Cost-effectiveness plane of domiciliary dental care compared with dental care at fixed clinic. Three models are displayed (A, B, and C) all using the cost findings from the base case cost analysis (Table 1). In model A the effect on quality of life was similar for the two alternatives, in model B the quality of life was considered to be improved by domiciliary dental care, and in model C the quality of life was considered to be reduced by domiciliary dental care.

recruitment of new patients. County councils had incentives to control the dental care chains and to minimise their costs, and thus the budget impact. The nursing homes had incentives to hold down their own costs and therefore to reward domiciliary dental care, which also could lead to a substantial influence on the patients' choice. Domiciliary dental care also reduces the cost of transportation services for the municipalities, but since the link to the patients was obscure, the municipalities' theoretical incentive was deemed unlikely to influence the patients' choice of dental care provider.

Discussion

Economic consequences of domiciliary dental care for elderly nursing home residents in Sweden were compared to dentistry at a fixed clinic. The cost of a domiciliary dental care appointment was lower than the appointment at a fixed dental clinic, and domiciliary dental care was considered cost effective compared to dental care at a fixed clinic. Sensitivity analyses revealed that lower cost of dental care at a fixed dental clinic was only achieved in a scenario where dental care could not be completed in a domiciliary setting. The study was conducted in the Östergötland County in Sweden, and the findings are considered largely representative for a majority of the Swedish counties, where domiciliary dental care is available for elderly nursing home residents.

Based on available data, it was not possible to make quantitative calculations of the effects included in the cost-effectiveness analyses. It was also problematic to analyse the concept 'quality of dental care' since its meaning varies between individuals. The anticipated effects of the different dental care forms were thus elucidated through economic theory mainly to understand the market impact.

The main advantage of a fixed clinic is that all dental equipment is available, which reduces the risk of occasions where the treatment cannot be completed. It may also be easier to establish a proper hygiene standard at a fixed clinic through a better possibility to ensure aseptic conditions. Domiciliary dental care may entail some limitations in the dental care that can be provided, and less favourable working environment for the dental staff. It is therefore essential that the mobile dental equipment meets necessary requirements regarding working environment, hygiene and quality standards. Divergence from the equipment available at a complete mobile dental clinic may lead to reduced possibility to perform more advanced treatments, such as surgical procedures and root canal treatments. The hygiene standard or quality of dental care has no obvious connection to the mobile equipment characteristics. However, working with domiciliary dental care sets demands on the dental staffs' skills to work hygienically, and the treatment level should be adapted to the available equipment and the patients' ability to cooperate. Limitations of the treatment panorama encountered in domiciliary dental care should be related to the risk of not getting access to dental care at all, especially if the patients have difficulties in being transported to a fixed clinic.

An analysis of the identified aspects in relation to the British Society for Disability and Oral Health decision

support model was also made. Based on the discussion above the model was not deemed to be suitable in the Swedish context since it does not include patient preferences (and the patients are free to choose dental care provider).

In an earlier study, a South African public service mobile dental clinic was evaluated showing that this form of care was both accessible and cost-efficient (Holtshousen and Smit, 2007). In a Finnish study one in four home-dwelling older people preferred a dentist visit at home ahead of fixed clinics. The preference for choosing domiciliary dental care was associated with impaired cognitive function, reduced capacity for activities of daily living, as well as with living alone, and use of home care services (Komulainen *et al.*, 2012). Therefore, it is plausible that an even higher proportion of elderly nursing home residents would prefer domiciliary dental care.

Domiciliary dental care enables dental services in the patients' residences and implies increased opportunities to provide dental care to individuals that are frail or with multiple illnesses. It also enables individuals with high care needs the possibility of maintaining good oral health through regular check-ups and preventive measures that otherwise might have been missed. Cumbersome journeys required to visit a fixed clinic are reduced and may reduce patient anxiety, and thereby reduce the need of sedative medication. Domiciliary dental care also gives added value for nursing home staff in terms of reduced need for staff assistance and reduced transport costs for the municipalities.

To create a functional dental market, it is important to streamline and develop the interplay between the different stakeholders on the dental market (i.e. patients, providers of dental care, county councils, and nursing homes). If elderly nursing home residents are given priority there is a risk of displacement effects, as other treatments may be held back. Although these displacement effects are considered marginal, all stakeholders involved should be aware of health care ethical issues, and combine their capacities to establish a well-functioning collaborations, and continuity in the care chains. Dental care for elderly nursing home residents should be provided at different settings to improve the accessibility to dental care. Availability of different dental care forms is economically efficient from a societal perspective, but requires interaction and collaboration between stakeholders in the dental market, as well as systems providing continuity of dental care for elderly nursing home residents. Providing alternative forms of dental care to improve access for frail groups in society will contribute to enabling patients to maintain a proper oral health in later life. Individual risk analysis as well as societal costs and personal preferences must be considered when planning and supplying oral health care.

Acknowledgements

This study was funded by CMT at Linköping University, and Oral Care AB. The funding from CMT was within a framework agreement between CMT at Linköping University and County Council of Östergötland. Potential conflicts of interest: At time of the study's initiation SO was employed by The Dental Commissioning Unit, County Council of Östergötland, and OS, MZ, and PS were employed by the dental care provider Oral Care AB.

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