Author(s): Aalto, L., Saari, A.

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Re-engineering of the meal logistics in a sheltered house for elderly people

Leena Aalto and Arto Saari

Faculty of Engineering and Architecture, Department of Structural Engineering and Building Technology, Helsinki University of Technology, Helsinki, Finland

Abstract

Purpose - The goal of this study was to perform an economic comparison of alternative service concepts designed to improve the productivity of nursing care in a refurbishment project of selected sheltered housing facility.

Methodology/Approach - In the study four different service development options were identified for the dining and kitchen facilities: the dining facilities were either decentralised or centralised, and the meals were prepared on site or brought in from outside.

Findings - The form of dining model chosen affected the operating costs more than the spatial costs. The biggest differences in operating costs were attributable to the meal price and to the costs of transferring disabled residents to the dining area. The study showed that the option, which had the lowest spatial costs, surprisingly had the highest total costs. This was the option in which the meals were conveyed to the decentralised dining rooms located on the different floors by the food supplier. The total costs of this option were 50 per cent higher than the total costs of the decentralised option with on site cooking facilities. The centralised dining option with externalised food service had considerably lower renovation costs but 15 per cent higher total costs than the lowest cost option (decentralised dining option with own kitchen).

Originality/value - The present paper provides a practical model for taking into account not only remodelling costs but also operating costs in total cost calculations of remodelling process.

Keywords: housing, elderly, care, remodelling, operating costs, centralised, decentralised

Paper type Research paper

Introduction

In 2005, the EU Commission issued a Communication concerning demographic issues, in which it was stated clearly that Europe is currently facing unprecedented demographic change. In 2003, the natural population growth rate in Europe was just 0.04 per cent p.a. The population structure is changing radically, particularly in regard to the growing proportions of older workers (aged 55-64), elderly people (aged 65-79) and the very elderly (aged 80+); at the same time the proportions of children, young employees and young adults are falling.

The growth in the number of workers aged 60+ is continuing, and will stop only around 2030, when the post-war baby-boom generation becomes elderly. As the baby-boom generation moves through the age pyramid, older cohorts will become more numerous than the younger ones. The total EU-25 population has grown from 350 million in 1950 and 418 million in 1975 to 450 million in 2000. In 2025, the population is expected to be 470 million, but after this it is likely to decrease, reaching 449 million in 2050. In other words, it will take two more decades before ageing starts to have a negative effect on the absolute size of the population. On the other hand, the effect of ageing on the age composition will be evident at a much earlier stage and is therefore of much greater significance for the labour market and the health and long-term care sector (Communication from the Commission, 2005).

For elderly people in Finland exist private and municipal nursing homes, sheltered houses and old people's homes, or they live at home. Housing type depends on person's financial situation and physical condition. People's need for assistance increases with age. It is estimated that 30-40 per cent of over-65s in Finland need some kind of assistance in coping, and about one fifth of the over-80s need a considerable amount of daily help (Vaarama, 1995). Combined with the rapid growth in the size of the elderly population, this means that substantial development investment will have to be allocated to different forms of residential care facility and care services for the elderly.

Care sector employees are burdened by the traditional stresses of institutional care for the elderly, i.e. a heavy workload and excessive physical demands. These produce both physical and mental stress symptoms. These employees are

especially exposed to the strains of poor ergonomic conditions, typified by difficult lifting movements and work postures.

There is a lack of systematic information about the costs and benefits, and, more fundamentally, about the feasibility of adapting residential accommodation for use as sheltered housing (Lansley *et al.*, 2004). The amount of research on the quality and costing of different designs for sheltered housing has been inadequate. Nevertheless, according to Torrington (2004), buildings can be adapted and changed and can "learn" to fit their purpose better. In productivity analyses of care work, more attention should be paid to the impact of different designs on the costs of the activities performed within the premises and also the effect on total costs.

From the point of view of cost-effective care, it is important that overall costs are examined as the sum of the different factors involved. If the care work is analysed as a whole, i.e. as a product of the building design and the activities undertaken, the information obtained will prove valuable in improving and developing the spaces and activities in the future. In parallel with the overall financial considerations involved in a project, the effects of proposed measures on the quality of accommodation and on the various activities performed must also be examined, as much from the resident's viewpoint as that of the nurses. Likewise, Torrington (2007) stresses that new methods for procuring buildings have highlighted a need for systematic evidence-based methods for evaluating designs.

The aim of this study was to calculate the cost-efficiency of alternative building renovation and alteration measures of meal logistics designed to improve the productivity of care work in a residential care facility for the elderly, using a particular sheltered housing complex as an example.

Methodologies

The study involved drawing up alternative facility development proposals for an existing municipal sheltered housing complex, where the elderly can live in an independent residence and have round-the-clock care. The focus was on examining the overall cost impact of decentralising certain services. A decentralisation/ centralisation model was first devised and construction plans

then drafted with the aid of experimental design. Next, the manager, the ergo-therapist and five nurses of the housing complex were interviewed. The purpose of the interviews was to become acquainted with routines and troubles of daily duties in the nurses's work. Likewise, some small-scale practical tests, e.g. following up nurses and making field observation during their care duties, were performed on site in cooperation with the sheltered housing staff. A researcher walked for two days with nurses and observed their work. She also observed the use of time in care work and made graphs of walking routes on the floor plans. Time measurements were made in conjunction with the tests, for the purpose of analysing the decentralisation of service spaces. Finally, a financial assessment was made of each alternative development proposal in terms of its construction and maintenance costs and costs of care provision.

Research subject

The example chosen for the study was a sheltered home for the elderly in Helsinki, completed in 1979. It comprises five four-storey residential blocks and a single-storey service centre. The dwelling units consist mainly of one-room (30 m^2) and two-room (41 m^2) apartments. The complex also includes a 12-bed community home for people with dementia. The site has a 24-hour emergency service. Figure 1 shows the site plan, which illustrates how the various buildings are located around the complex. The whole complex was upgraded in the 1990s, including bathroom extensions in some apartments.

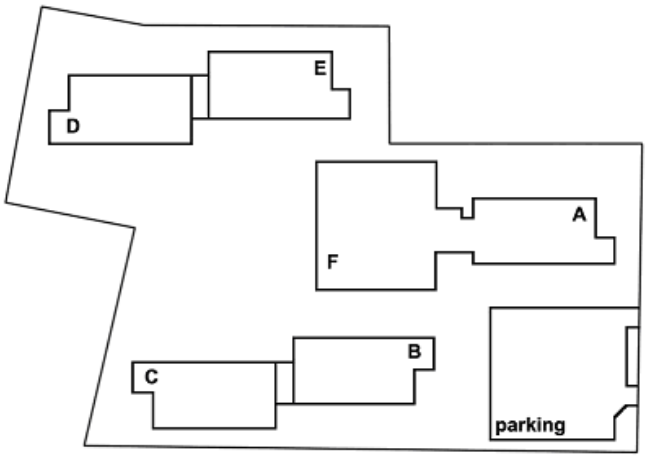


Figure 1. The existing site plan of the sheltered home for the elderly.
A: dwellings, B-C: dwellings, D-E: dwellings, F: service centre

The average age of the sheltered home's residents is high: 80 years old. According to the management, the composition of residents will have changed by 2010, as there will no longer be any residents in good health. Instead, most will be elderly people needing daily assistance or suffering from dementia.

Creating the model

The facility development model used in the study is designed to compare centralisation and decentralisation of the home's services, and also the outsourcing of services. The sheltered home's services are currently arranged according to the centralised model.

In Alternative C (centralisation) of the facility development model, the services are centralised in a separate service centre. In Alternative DC (decentralisation), the services and the spaces required for mealtimes are decentralised onto each residential floor. This means a reduction in the living space, because this decentralised model includes converting some of the dwelling space into service facilities.

In Alternative C-K (centralisation + kitchen), meals are prepared in the home's own institutional kitchen, while in Alternative C-O (centralisation + outsourced meals), semi-prepared food is brought from elsewhere and warmed up in the kitchen. The dining itself takes place in the service centre in both centralisation alternatives. In Alternative DC-K (decentralisation + kitchen), the lunch meal is prepared in the home's own institutional kitchen and taken on meals trolleys from the kitchen to the dining rooms on each residential floor. In Alternative DC-O (decentralisation + outsourced meals), the lunch meal is brought in (packaged) as an outsourced service directly to the decentralised dining rooms.

Field observations

Before the activity monitoring was carried out, interviews were conducted with the home's ergo-therapist in order that sufficient information could be obtained on the treatment measures for the elderly residents as a basis for the observations to be made during the study. During the period of activity monitoring, interviews

were also conducted with the nurses so that their views about the facilities and the activities carried out within them could be obtained.

At the first stage of the study a member of the study team spent two days in December 2004 recording the use of time by five different nurses, including details of the various actions undertaken and transfers from one place to another.

Later, on a third monitoring day in June 2005, the researcher recorded the time spent in taking wheelchair users to the dining hall in the service centre and back again to their apartments. In the centralised alternative this transfer is from the apartment to the service centre, while in the decentralised alternative it is always on the same floor of the residential block where wheelchair user lives. The aim with both these measurements of time use was to compare the differences in nurse time between the centralised and decentralised alternatives.

Calculation of construction and maintenance costs

Calculation of the refurbishment and maintenance costs was carried out using the Taku 2005 costing programme of Haahtela-Kehitys Oy. The programme was used to calculate the target prices for both refurbishment costs and maintenance costs for the facility development alternatives.

The calculations for the decentralised model were made as per the centralised model, but with the addition of the new dining facilities decentralised on each floor, which were included in the form of comprehensive renovations of the fullest kind. In the decentralised alternative, one apartment (30 m^2) is converted into a dining room on each residential floor. Since there are three residential blocks (Blocks A, B-C, D-E) and four floors in every block, there are 12 new dining rooms in all. The unheated balconies connecting the blocks were also renovated to become heated spaces.

The space inventory for the new dining facilities consist of the following: kitchenette 5 m^2, dining room 25 m^2, hallway 5 m^2 and connecting balcony 20 m^2, i.e. 55 m^2 in all on every residential floor. Since there are 12 renovated apartments, the total renovation area is 55 m^2 x 12 = 660 m^2.

The calculations were based on the assumption that the service centre would be pulled down, due to its poor condition, and a new centre built in its place. The new service unit was designed to include only the essential dining facilities for the

renovation model, plus the entrance hall, technical spaces and hallways. The space inventory of the service centre varied according to the alternative being considered. Table 1 shows the space inventory and the total size for the service unit under each alternative analysed.

Table 1. The space inventory of the service unit (Kustannustieto 1/2005)

		C-K	C-O	DC-K	DC-O
Number of residents		146	146	134	134
dining hall	1.2 m^2/person	175	175		
kitchen for warming food	0.6 m^2/portion		88		
institutional kitchen	0.7 m^2/portion	102		94	
programme area		**277**	**263**	**94**	**0**
entrance hall	5 per cent /programme area	14	13	5	0
technical spaces		26	14	9	0
hallway		52	30	17	0
TOTAL SIZE (m^2)		**369**	**320**	**124**	**0**

Calculation of operating costs

For the operating cost calculations, the costs of mealtimes were calculated separately on the basis of a field study. This measured the time spent by caregivers in the centralised and decentralised alternatives. The calculations included meal-taking twice a day. Measurements were made of the time spent taking wheelchair users to eat in the service centre or to the dining rooms on the residential floors. This also included time spent by the caregiver in taking meals trolleys to the residential floors and back to the service centre. Information on the actual cost of the meal services and the payroll costs of cooks were obtained from the home's management. The costs of the outsourced catering service and food materials were obtained from Helsinki City Social Services Department.

Calculation of total costs

The calculation of total costs was performed using an investment calculation. The total costs comprised the annual costs of both construction and maintenance and the operating costs. The construction and maintenance costs in turn consisted of the costs of renovating the service spaces and maintaining them. The real interest rate used in the calculation was 4 per cent, and the calculation period was 25 years.

The rental loss of those apartments (each 30 m^2), which were converted into new dining rooms on the residential floors, was also taken into account in the calculations. The rental loss amounted to €5.71/m^2 per month.

Finally, the combination of the construction and maintenance costs, the operating costs and the rental loss per resident incurred in the renovation measures was calculated.

Results

Decentralised v centralised model

The sheltered home case's residential blocks are currently joined by unheated, glazed connecting balconies, which turn pairs of residential blocks into larger entities (Figures 1 and 2). In the decentralised model, space for common meal-taking was also added at the link section by the connecting balcony in one of the renovation alternatives (Figure 2). In both models a new service unit is built on the site of the dismantled service centre, in the inner yard between the residential blocks. Since 12 apartments are converted into dining facilities in the decentralised model, the number of residents and the scale of the service unit vary from one renovation alternative to the next.

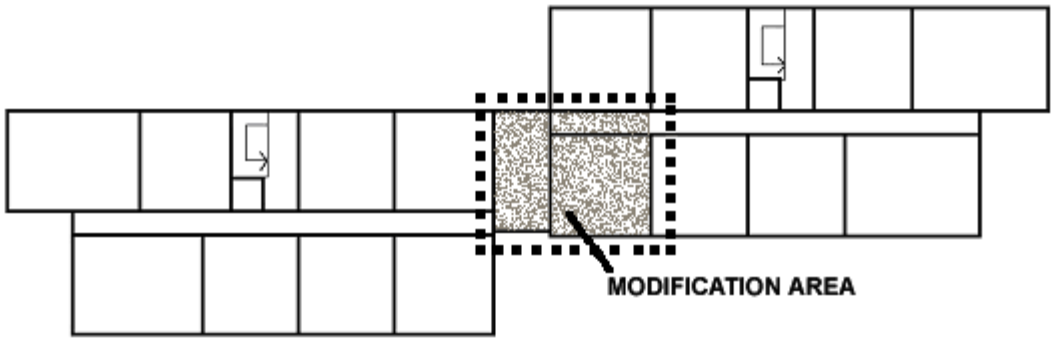


Figure 2. An extract from the floor plan of one residential floor, illustrating the present location of the apartments on that floor. The modification area is shown with dotted line.

Service models studied

In the cost comparison of meal-taking, the calculations included the costs of renovating and maintaining the dining and kitchen facilities, the costs involved in the nurses taking residents to the dining facilities and back, and other functional

costs in relation to dining. A ‘four-square model’ of meal provision was devised for the study, consisting of four different service alternatives (Figure 3).

The model has two variables: decentralisation of meal provision and outsourcing of food preparation. Thus, the model contains a different combination in each of its squares. Category C combinations were the kitchen option and the meals service option of the centralised model, and Category DC combinations were the corresponding alternatives under the decentralised model.

Figure 3 shows the four combinations with their descriptions. The following abbreviations for the combinations were drawn up for the purposes of the calculations:

(1) C-K (centralised, kitchen)
(2) C-O (centralised, outsourced meals service)
(3) DC-K (decentralised, kitchen)
(4) DC-O (decentralised, outsourced meals service)

	C - CENTRALISED MODEL	DC - DECENTRALISED MODEL
KITCHEN	ALTERNATIVE C-K spaces: - new service centre with dining hall and institutional kitchen/2 cooks activities: - taking residents to the dining hall	ALTERNATIVE DC-K spaces: - new local dining facilities on residential floors - institutional kitchen/2 cooks activities: - taking residents to the local dining facilities - meals trolleys to the local dining facilities
OUTSOURCED MEALS	ALTERNATIVE C-O - spaces: - new service centre with dining hall and kitchen facilities for warming food/2 cooks - outsourced (semi-prepared food) meals service activities: - taking residents to the dining hall	ALTERNATIVE DC-O spaces: - new local dining facilities on residential floors - no kitchen activities: - taking residents to the local dining facilities - outsourced meals service (packaged)

Figure 3. The meal provision model

Figure 4 gives the explanations for the symbols used in the following picture series (Figures 5 and 6) where the functional and spatial differences of the alternatives are described.

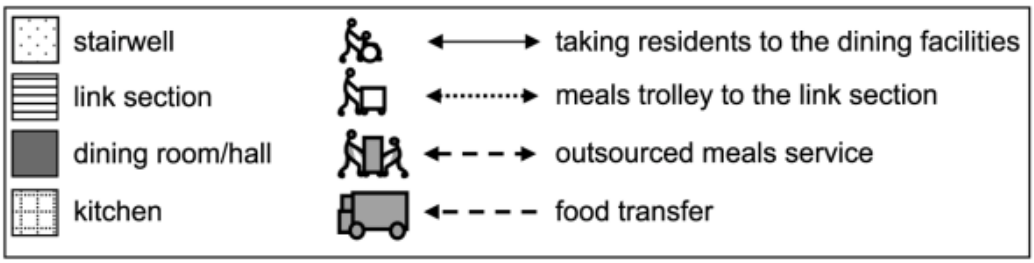


Figure 4 Explanation of symbols

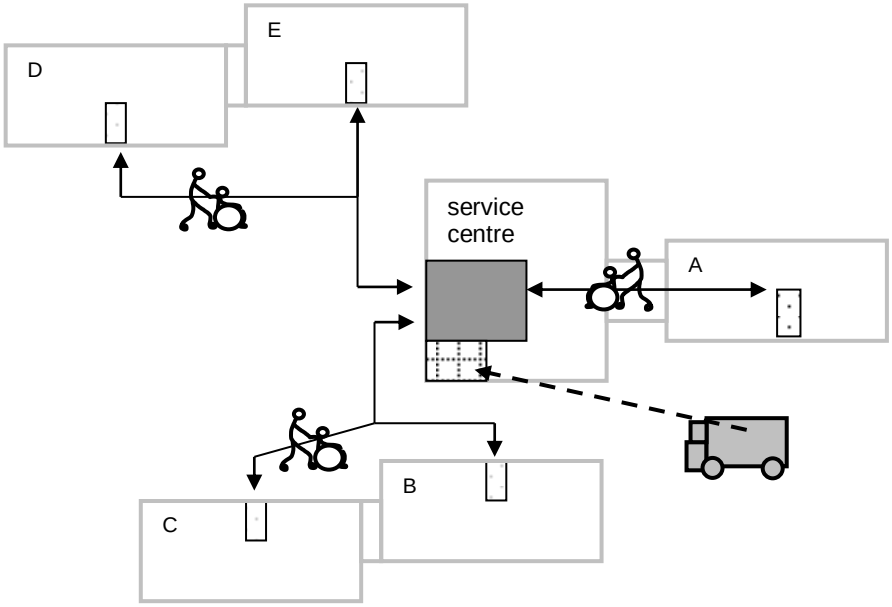
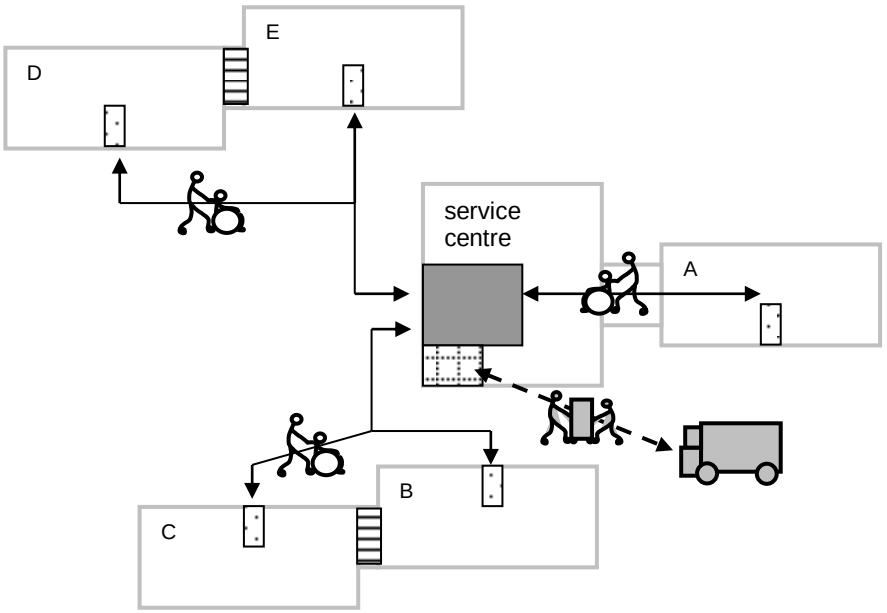
C-K Centralised alternative with institutional kitchen. The nurses take wheelchair users to the service centre for meals. The food materials are transferred to the kitchen, where cooks prepare the meals.	
C-O Centralised alternative with kitchen facilities for warming food (corresponding to existing situation). Semi-prepared food is transferred to the kitchen and warmed up there. The nurses take wheelchair users to the service centre for meals.	

Figure 5 Centralised alternatives C-K and C-O

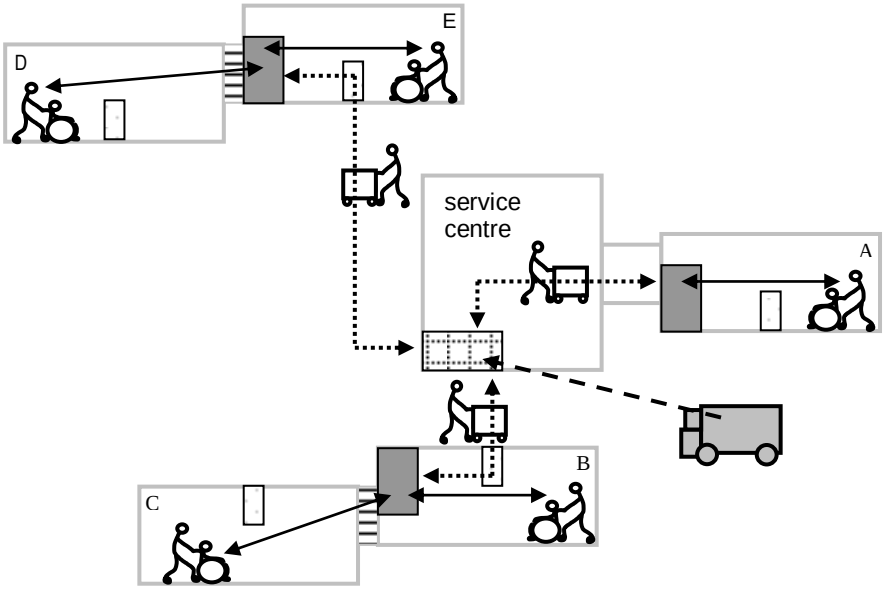
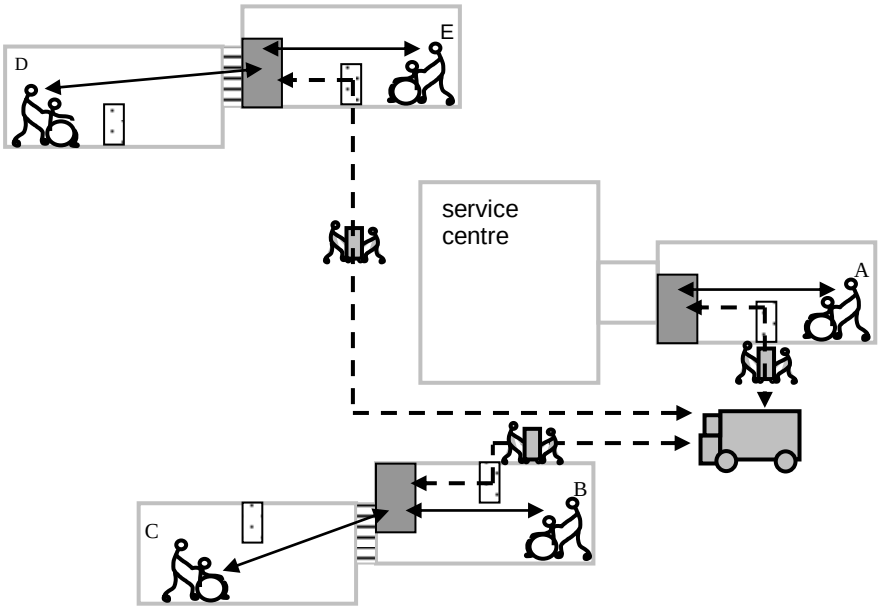
DC-K Decentralised alternative, where food materials are transferred to the kitchen, where the cooks prepare the meals. The nurses take meals trolleys to the dining rooms situated in the link sections. The nurses take wheelchair-using residents to dining rooms.	
DC-O Decentralised alternative with outsourced meals service. The meal packages are brought to the dining rooms situated in the link sections. The nurses take wheelchair-using residents to the dining rooms.	

Figure 6 Decentralised alternatives DC-K and DC-O

Results of monitoring nurses' use of time

On the third monitoring day the nurses' time spent taking wheelchair users to the dining facilities was monitored. The time taken from different apartments located on the various floors was recorded, as well as for the short distance from the ground floor of the link section and the longest possible distance from the top

floor (level four). The time taken in using the lift was also recorded, as was the time from the ground floor to the dining facilities in the service unit. As travelling to the dining hall involved being outdoors briefly, this would require dressing up warmly at cold times of the year, which consumes more of the nurse's time. This was taken into account in the calculations.

Measurements of time taken also included the nurses' time spent travelling back to fetch another resident after having taken the previous resident to the dining hall already. Likewise, when returning the residents to their apartments after the meal (see Table 2).

Table 2. Nurses' time spent taking wheelchair users to the dining facilities and back to their apartments in centralised/decentralised model (per one dining occasion).

CENTRALISED MODEL	time/ min.	time/ min.	**DECENTRALISED MODEL**	time/ min.
DWELLING/ ground floor	summer	winter	DWELLING/ ground floor	summer/winter
help with dressing	6	10	help with dressing	2
taking resident to the link	1	1	taking resident to the link	1
taking resident from the link	4	6	taking resident from the link	0
travelling back to fetch another	2	2	travelling back to fetch	0,5
total	**13**	**19**	**total**	**3.5**
DWELLING/ top floor (level 4)	summer	winter	DWELLING/ top floor (level	summer/winter
help with dressing	6	10	help with dressing	2
taking resident to the link	1	1	taking resident to the link	1
in elevator	1	1	in elevator	0
taking resident from the link	4	6	taking resident from the link	0
travelling back to fetch another	3	3	travelling back to fetch	0,5
total	**15**	**21**	**total**	**3.5**

With the assumption, in the centralised model, that there is in Finnish weather condition only a two-month period during the year (June and July) when residents would not need to dress more warmly to get to the dining hall via outdoors, the average use of time can be calculated using the following formula:

$$[(2/12 \times 13+10/12 \times 19) + (2/12 \times 15+10/12 \times 21)]: 2$$

$$= 19 \text{ (min/resident/mealtime)}$$

In the decentralised model, the corresponding time is an average of only 3.5 min/resident/mealtime, because meals are always taken on the same floor as the apartment. On an annual basis the corresponding times in hours are 116 h/resident (centralised) and 21 h/resident (decentralised).

Results of the cost calculations

Construction and maintenance costs

Based on the space inventory for each of the four alternatives, calculations were made of the construction costs (annuities) and maintenance costs.

Table 3. Construction and maintenance costs of the service centre (dining hall and/or kitchen) (Kustannustieto 1/2005, costs valid for January 2005)

alternative	number of residents	number of dwellings	gross floor area	construction costs	construction costs (annuity)	maintenance costs	construction and maintenance costs	construction and maintenance costs /resident
			m^2	€	€/year	€/year	€/year	€/year
C-K	146	130	368	1017000	65100	35000	100100	686
C-O	146	130	350	830000	53130	29000	82130	563
DC-K	134	118	129	600000	38400	17000	55400	413
DC-O	134	118	0	0	0	0	0	0

Table 4. Construction and maintenance costs of the decentralised dining facilities (Kustannustieto 1/2005, costs valid for January 2005)

alternative	gross floor area	renovation degree	renovation costs	equipments	construction costs (annuity)	maintenance costs	construction and maintenance costs	construction and maintenance costs /resident
	m^2	%	€	€	€/year	€/year	€/year	€/year
C-K	0	0	0	0	0	0	0	0
C-O	0	0	0	0	0	0	0	0
DC-K	660	35	607000	34320	41044	39000	80044	597
DC-O	660	35	60 000	19320	40084	39000	79084	590

The renovation cost calculations for the decentralised model included the cost of installing a refrigerator, dishwasher, kitchen sink and tap in each of the new dining facilities on the residential floors (see equipments in Table 4). In addition, the decentralised Model DC-K included the costs of six meals trolleys, each €15000.

Rental loss caused by new dining facilities

Rental loss of the 12 apartments (each 30 m^2), which were converted into new dining rooms on the residential floors, was taken into account in the calculations. The rental loss per year is 12 mo. x 12 unit x 30 m^2 x €5.71/m^2/mo. = €24667. Since every resident uses the new dining rooms in the decentralised model, the rental loss concerns all residents and is equal to €184/resident/year (Table 5).

Table 5 shows the total construction and maintenance costs of the new service centre and the new dining facilities, and also the rental loss per resident. In addition, the total costs per resident per year are compared in relation to Alternative C-O.

Table 5. Total construction and maintenance costs of service centre and dining facilities (Kustannustieto 1/2005, costs valid for January 2005)

	service centre: construction+ maintenance costs/ resident	dining facilities: construction+ maintenance costs/ resident	rental loss/ resident	total construction+ maintenance costs/ resident	ratio
alternative	€/year	€/year	€/year	€/year	
C-K	686	0	0	686	1.22
C-O	563	0	0	563	1.00
DC-K	413	597	184	1195	2.12
DC-O	0	590	184	774	1.38

When the construction and maintenance costs of the service unit and the dwelling spaces were combined, the model with the lowest construction and maintenance costs was Alternative C-O, where dining is centralised in the service centre's dining hall and semi-prepared food is brought from elsewhere and warmed up in the kitchen facilities. The most expensive Alternative, DC-K, where dining is decentralised in new dining rooms on the residential floors and a new institutional kitchen is built in the service centre, has total construction and maintenance costs that are more than double compared with those of the lowest cost Alternative C-O.

Operating costs

The calculation of operating costs for the four alternative dining forms took the following costs into account:

- taking residents to the dining facilities (to the dining hall/decentralised dining rooms)
- taking meals trolleys to the dining rooms in the link section
- cost of meals

Taking residents to the dining facilities

For the calculations, it was assumed that residents would be taken twice a day to the dining facilities. The nurse's hourly pay was specified as €17, including social security costs.

The total costs of taking residents to the dining facilities were also calculated for the whole year. Thus, the total costs per resident in the centralised model were €17/h x 116h x 2 = €3944, and in the decentralised model €17/h x 21 h x 2 = €714.

With an average of 50 wheelchair users in the sheltered home, the total annual costs in both centralised alternatives are 50 x €3944 = €19200, and in both decentralised alternatives 50 x €714 = €35700 (Table 6).

Meals trolleys to the link section

In Alternative DC-K meals trolleys are taken from the institutional kitchen to the link section on each floor at mealtimes. Taking the meals trolley to the dining room and back to the kitchen takes the nurse an estimated 20 min/mealtime, and this occurs twice a day. Two meals trolleys are needed per three blocks (trolley/2 floors), that is, six trolleys in all. The annual costs of taking meals trolleys in Alternative DC-K are therefore 20 min/60min x 2 times/day x 6 trolleys x 365 days/yr x €17/h = €24820 (Table 6).

The nurses who deliver the meal do transferring the meals trolley between two floors. So it is not included in the calculation.

Costs of the meals service

In Alternatives C-O and DC-O, an outsourced meals service is used. The cost of this service is €4.10/meal in Alternative C-O, and €8.40/meal in Alternative DC-O. Since the meals service is twice a day, the annual cost is €4.10/meal x 146 person x 2 times/day x 365 days/yr = €436978 in Alternative C-O, and €8.40 x 134 x 2 x 365= €821688 in Alternative DC-O (Table 6).

Cooks' payroll costs

The annual payroll costs (including social security costs) of a cook working in the institutional kitchen or in the kitchen facilities for warming food, are approximately €21 800. At least two cooks are needed in the kitchen during the

day, and so the annual payroll costs in both centralised models and in the decentralised Model DC-K are 2 person x €21800€/person = €43600 (Table 6).

Cost of self-cooked meals

In Alternatives C-K and DC-K, the cost of food materials for two meals a day also has to be taken into account. Figures from Helsinki City Social Services Department show that the price of one self-cooked meal is €3.80 (in both alternatives). The number of residents differs by 12 between these two alternatives, however, and so the cost of self-cooked meal in Alternative C-K is €3.80/meal x 146 person x 2 times/day x 365 days/yr = €405004, and in Alternative DC-K €3.80 x 134 x 2 x 365 = €371716.

Total operating costs

Table 6 shows all the per-resident operating costs and the total costs. In addition, it compares the lowest cost model with the other alternatives.

If only the operating costs are analysed, the lowest cost model is Alternative DC-K, at €3259/resident/year. In this alternative, the dining is decentralised and takes place in new dining facilities on the residential floors. By contrast, the operating costs in the highest cost model (Alternative DC-O, with a high combined cost impact of the meals service and taking residents to the dining facilities) are as much as 80 per cent higher than the costs of the lowest cost model (Table 6).

Table 6. Annual operating costs of alternative dining forms (Kustannustieto 1/2005, costs valid for January 2005).

	residents	resident transfer/ 50 residents	meals trolley transfer	meals service	pay roll cost/ 2 cooks	cost of finished food	total operating cost	total operating cost / resident	ratio
alternative	no.	€/year	€/year	€/year	€/year	€/year	€/year	€/year/resident	
C-K	146	197200			43600	405004	645804	4423	1.36
C-O	146	197200		436978	43600		677778	4642	1.42
DC-K	134	35700	24820		43600	371716	475836	3259	1.00
DC-O	134	35700		821688			857388	5873	1.80

Total costs

Finally, the total costs of the combinations were calculated (i.e. the construction and maintenance costs and the operating costs per resident incurred in the renovation measures). The cost was highest, at €6647/resident/year, in the decentralised model Alternative DC-O, in which dining is decentralised to separate dining facilities on the residential floors and the outsourced meals service brings the meal packs to these dining facilities. This particular model was 49 percent more expensive than the lowest cost (€4454/resident/year) Alternative, DC-K, in which the dining is decentralised to the residential floors and meals are cooked in an institutional kitchen (Table 7).

Table 7. Annual construction and maintenance costs, operating costs, and total costs in all alternatives (Kustannustieto 1/2005, costs valid for January 2005).

	construction and maintenance costs/resident	operating costs/resident	total costs/resident	ratio
alternative	€/year	€/year	€/year	
C-K	686	4423	5109	1.15
C-O	563	4642	5205	1.17
DC-K	1195	3259	4454	1.00
DC-O	774	5873	6647	1.49

When the operating costs were taken into account, the ranking of the alternatives in the final results changed significantly. Alternative DC-K, which was substantially more expensive than other alternatives in terms of construction and maintenance costs, became the lowest cost alternative overall, after taking into account the operating costs.

Discussion

In this study, four different facility development alternatives regarding the dining and kitchen options were created for the sheltered home being studied. In these alternatives the dining facilities were either centralised or decentralised, and the meals were either self-cooked or purchased from elsewhere (outsourced).

The study demonstrates that decision-making about renovation options in sheltered homes for elderly people should also take into account the operating costs associated with each option, and not simply the construction and maintenance costs.

In this case study, the construction and maintenance costs differed by €630/resident/year between the lowest and the highest cost alternatives, and the operating costs differed similarly by €2600/resident/year. The form of dining facilities affected the operating costs more than the construction and maintenance costs.

The biggest differences in operating costs were due to the meal costs and the costs of taking residents to the dining facilities.

The calculations showed that the alternative with the lowest renovation cost nevertheless had the highest total costs. In this alternative the meal service packs are brought to the decentralised dining facilities. The total costs of this alternative were 50 per cent higher than the total costs of the other decentralised alternative with an institutional kitchen.

The centralised alternative with an outsourced meals service had a significantly lower renovation cost, but 15 per cent higher total costs, than the lowest cost decentralised alternative with an institutional kitchen.

It should be emphasised that the economic benefit of solutions, which have higher renovation cost but lower operating costs due to reduced workforce needs will not materialise if the staff levels are not reduced.

In DC-O model the centralised kitchen/service centre becomes redundant and could be used for another function e.g. for recreation activities or it could be hired for cafeterian use. In the service centre there is also other activities like sauna, thus the building cannot be demolished. Nevertheless, the focus in this study was the meal logistics of alternative building renovation options, hence the future of the kitchen/service centre is not discussed here further.

Many studies have been published in recent years about personnel wellbeing, and there is considerable information about the costs of institutional care. However, the impact of operating costs on total costs has not been studied until now. This approach to examining all economic implications is likely to be a very productive research field in the next few years.

These results provide useful information for the design solutions of sheltered homes for elderly people. The outcome of the calculations will vary according to the case in question, however, since the space arrangements may vary quite considerably.

The results of this study demonstrate that decision-makers in real estate companies and in communities must take into account the impact of operating costs when considering the costs of building sheltered homes for the elderly.

The comprehensive care of elderly people will be a major challenge for society in the future. From the point of view of nursing quality, it is essential to pay careful attention to the operating activities and time spent in these activities, so that nurses can perform their tasks properly and remain fit for work as long as possible.

According to Torrington (2004), estate management should be seen as a creative process. The size and the location of spaces, and their relation to nursing activities, have to be carefully planned right from the start of the design process, both in renovation work and in new construction.

Likewise, the rationalisation of material flows, especially concerning meals, incontinence pads, medicines and prescriptions, has to be taken into account during the design process if this is to help in minimising total costs.

In this study neither the residents nor the nursing staff were asked about their preferences. Although, in overall cost terms, the best alternative was the decentralisation of dining facilities to the residential floors, the residents themselves may still prefer dining in a large dining hall for social, psychological and functional reasons.

In the example chosen sheltered home for the elderly has been put into practice alternative DC-K, which proved to be the best alternative in this study. The thoughts of all parties e.g. the nursing staff and residents involved will be interviewed after construction work.

In addition, food and dining habits among the elderly is the study area in another project executed in Helsinki University of Technology in 2007-2008. The results of this study will be reported in near future.

An interesting aspect for further research is to examine the impact on operating costs (and hence total costs) if the composition of residents is different, in terms of the demands associated with their mental alertness and physical condition.

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