

## **A break-even analysis of delivering a memory clinic by videoconferencing**

Tracy A Comans(1,2), Melinda Martin-Khan(3,4), Leonard C Gray(3,4) and Paul A Scuffham(1,2)

1 Centre for Applied Health Economics, School of Medicine, Griffith University, Brisbane, Australia

2 Population and Social Health Research Program, Griffith Health Institute, Brisbane, Australia

3 Centre for Research in Geriatric Medicine, School of Medicine, University of Queensland, Brisbane, Australia

4 Centre for Online Health, School of Medicine, University of Queensland, Herston, Australia

## **Summary**

The use of telehealth, in place of conventional memory clinics for diagnosis, as a means of providing access to specialist diagnostic services is beneficial for patients who have to travel long distances to attend a clinic appointment. The diagnosis of dementia via videoconferencing has been shown to be reliable. The aim of this study was to estimate the break-even point where, given a certain distance from the provider, videoconference and face-to-face services are equally efficient in providing a memory clinic health service. The intervention was a telemedicine memory clinic. All patients were referred to the memory clinic by their general practitioner (GP). A clinic nurse completed face-to-face standardised assessments with the patient, and a specialist carried out the clinical assessment via video. This was followed by a case meeting with the referring GP maintaining clinical management of the patient following the clinic visit (N=205). A break-even analysis was carried out using three variables: fixed costs, variable costs and savings. The break-even point is where total cost equals total revenue. This point is determined where the benefit curve (of using videoconferencing) intersects the total cost curve (of face-to-face) using the formula  $Q=FC/(S-VC)$ . A sensitivity analysis was conducted based on one specialist traveling to perform the clinic. Assuming identical effectiveness of the services, if the travelling time exceeds 138 minutes (round trip), it is more efficient to provide videoconferencing.

## **Introduction**

Dementia is a common condition: in 2008, dementia was the fourth most common cause of death for Australians living outside a major city.[1] Management of dementia often requires patients to attend clinics in major cities or specialists to see patients in rural clinics. Travel distances for both patients and specialists may be substantial. Videoconferencing therefore offers potential advantages over face to face (FTF) assessment.

A recent study of different models of care in an Australian metropolitan memory clinic[2] found that videoconference assessment was as reliable as conventional FTF assessment in the diagnosis of dementia. It would therefore be useful to know when it is efficient to provide services in a conventional FTF format and when to provide services remotely. We are not aware of previous economics studies of videoconferencing for the diagnosis of dementia.

The aim of the present study was to compare the costs of two kinds of dementia clinic. In the conventional clinic, held in a rural area, the specialist travels to the clinic from the city. In the videoconferencing clinic, patients are also seen in a rural area, but the specialist conducts the assessment by video from the city.

## **Methods**

The analysis took the perspective of the health funder who must provide services to meet the patients' needs, either by providing clinics in regional centres or by providing equivalent telehealth services.

A model was developed using a spreadsheet (Excel 2010, Microsoft) to estimate the point where the costs of providing a clinic in a regional centre were equal to those of providing the same service by videoconferencing. The data were based on a sample of older adults (n=205)

who participated in a trial of two models of cognitive assessment: conventional (face-to-face) or videoconferencing, and from literature sources. Details of the recruitment and randomisation process have been published elsewhere.[2,3]

Two models of service delivery were compared: Conventional Regional Clinic and Videoconference Clinic.

#### *Conventional regional clinic*

The specialist travels to the regional clinic from their usual workplace in the city centre, in order to provide services face-to-face. A series of standardised cognitive assessments are administered either by the specialist or a geriatrics nurse at the clinic, and a formal assessment is carried out by the specialist on the same day. This may include a physical examination. If there is sufficient evidence of dementia a diagnosis is made, otherwise referral for additional testing or review by a different specialist is made.

#### *Videoconference clinic*

The specialist conducts the clinic from their usual workplace in the city centre by videoconference. The same set of standardised tools is administered by a nurse in person, followed by a videoconference assessment by the specialist, after which a case meeting is held to confer on diagnosis and management. Additional tests such as MRI scans are ordered if warranted. Management is followed up by the referring practitioner (usually the general practitioner).

#### *Assumptions*

The primary assumption is that the outcome is the same for each modality. This is based on the outcomes of a previous clinical trial.[2] Additional assumptions are:

- (1) Clinics are conducted by one specialist and one nurse.
- (2) Annual training is required for the nurse. This is conducted in Brisbane and takes four hours. A full day's pay is assumed, plus \$500 travel costs to attend.
- (3) 12 clinics are conducted in one year, so that the annual costs of videoconferencing and training are divided by 12.
- (4) Clinics consist of two new assessments with one follow up assessment. For new assessments, the consultant spends an hour with the patient and for follow up cases, half an hour. The nurse spends one hour with each patient and carer, regardless of whether the appointment is for an initial or follow up consultation.
- (5) Travel by the specialist is assumed to be by motor vehicle. A comparison with costs by air travel is presented in a sensitivity case.

#### *Measurements*

The fixed costs common to both modalities, such as clinic infrastructure, were ignored. The variable costs were the travel costs for the specialist and specialist's time while travelling.

Costs were obtained from the Diagnostic Accuracy study[2] and from local data. Costs for the routine set-up and running of videoconferencing hardware were taken from an Australian study[4], and from the commercial rental rate of room hire. Wage rates were calculated from Queensland Health award rates for the staff concerned. Vehicle costs were estimated from Australian Tax Office rates per kilometre and converted to rates per minute by estimating the

time and distance for three common destinations from Brisbane.

The break-even point is the specialist's travel time at which the cost of the two modalities is the same.

## **Results**

The total fixed cost of a conventional clinic was \$522 and the total fixed cost of a videoconferencing clinic was \$881. The additional variable cost of the videoconferencing clinic was \$2.62 per minute of the specialist's travelling time made up of travel costs and staff wages, see Table 1.

The break-even point is shown in Figure 1. At a travelling time of a little over two hours (138 min round trip), the two services have the same cost. If the travelling time is greater than this, it is more efficient to provide the service by videoconferencing and if the travelling time is less than this, it is more efficient to provide a conventional face-to-face service.

A sensitivity analysis is provided in Table 2. The break-even analysis is not particularly sensitive to changes in staff wages. Increasing wages makes the videoconferencing service slightly more favourable but only by nine minutes, and decreasing wages favours the conventional service slightly.

The analysis is somewhat sensitive to the non labour costs of videoconferencing with an increase of 50% of these costs associated with an increase of travelling time required to become cost identical of around one hour.

The base case assumes that a nurse will be available at the remote centre to conduct the clinic. If this is not feasible the nurse may travel with the consultant to the clinic. For this scenario, the cost of training the nurse at the remote centre was excluded for the conventional clinic resulting in a lower cost of \$436 for the clinic. Despite this, the overall result is very similar as the increased travel costs of the additional staff member cancel out the lower clinic cost. A further analysis assumes a travelling cost associated with air travel rather than car travel. This analysis assumes a cost per minute of air travel of \$4.00 per minute based on travel times and economy prices from three common regional destinations to Brisbane: from Mt Isa, Townsville or Winton. This analysis shows that air travel is substantially more costly than car travel and with a breakeven point of under an hour and a quarter.

Reduction of the number of clinics to six results in a much higher cost of running the videoconferencing service compared to the conventional service as costs such as service testing fees and annual broadband (DSL) fees are averaged over half the number of clinics as for the base case. The result of this is an increased travel time required for the services to break-even. Indeed a five hour round trip would be required before it would be more efficient to provide videoconferencing services over conventional clinics.

## **Discussion**

Previous research has shown that using a videoconferencing format for cognitive assessments is equally effective in detecting cognitive impairment and dementia as a conventional

model.[2,3,5,6,7,8] The present study adds to that research in determining where videoconferencing is a more efficient alternative to conventional care when certain distances for travel are reached. The analysis indicates that videoconferencing would be a more efficient alternative to face-to-face clinics if travelling time by car is over two and a half hours in a round trip. Air travel is not an efficient alternative as the costs reduce the break-even travel time to just over an hour, which is not practical given flight times, waiting times at the airport and travel to and from airport terminals. If a face-to-face clinic is conducted, it is also more efficient to have a nurse available at the remote centre rather than have a nurse travel with the consultant.

Given the costs in providing and maintaining videoconferencing equipment, it is important that it is used regularly to ensure the most efficient use of these resources. In actual clinical practice, the facilities may also be used for other types of specialist clinics and training so that the cost of the videoconferencing is probably lower than estimated for the present study. If this is the case, it could be more efficient to provide videoconferencing for travel times of less than two hours.

The analysis does not take into account opportunity costs of travel. If the consultant has to travel, that time is time that could otherwise have been spent treating patients. Given long waiting lists, particularly in public settings, there could be advantages other than saving travel costs to providing services by videoconferencing as it will allow greater numbers of patients to be seen and reduce waiting times and pressure in the hospital system. Reduction of waiting times could lead to improved patient management of cognitive decline, preventing hospital admissions by providing immediate specialist support.

The study was based on the question of travel time (or distance) but the benefits can also be applied to people who find travel difficult, regardless of the distance. Urban telehealth is the use of technologies such as videoconferencing for people who find travel difficult. An example is residents of long term care facilities.[9,10] Residents may be frail and have multiple comorbidities making the short trip to a city clinic impossible. Very few long term care facilities have a regular geriatrician consultation service provided at the facility. Given that specialists are time poor, it is possible that the inclusion of videoconferencing equipment in a nursing home increases the feasibility of specialist cognitive assessment for residents of long term care, and eliminates the demands on a frail older person's health that come with travel.

### *Conclusion*

Videoconferencing for the purpose of diagnosing dementia is both a reliable and cost effective method of health service provision when a specialist is required to drive more than 164 minutes (round trip) to provide a memory disorder clinic service, or when the patient is frail and unable to travel (a person local to the memory disorder clinic, but residing in a long term residential care).

### **References**

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Table 1. Costs

1A. Fixed costs

	Unit cost (\$)	Cost per clinic (\$)
<b>Conventional and videoconferencing clinic</b>		
Specialist	112.54 per hour	281
Nurse	44.06 per hour	154
Training cost -- nurses[1]	44.06 per hour	37
Training cost -- neuropsychologist[2]	50.14 per hour	8
Travel for training	500	42
<i>Total fixed cost of conventional clinic</i>		522
<b>Videoconferencing</b>		
Setup costs (videoconferencing equipment and site visit)	15,354	-
Rental rate of videoconference room	6000 per year	16
Administration (setting up for consultation)[3]		22
Annual DSL fees	1082 per year	90
Service testing costs[4]	1440 per year	120
Nurse time for supervision of patients (2.5 h)	44.06 per hour	110
<i>Total additional cost of videoconferencing</i>		359
<i>Total cost of videoconferencing clinic[5]</i>		881

[1] Annual training requires one full day for the clinic nurse plus 2 h for a nurse trainer, a total of 10 h

[2] Annual training requires 2 h of neuropsychology time

[3] Set up requires 30 min of nurse time

[4] Equipment is periodically tested by a central technical department to ensure equipment functions for clinic appointment

[5] Total equals the cost of conventional clinic plus additional videoconferencing costs

1B. Variable costs for specialist to travel

	Cost (\$/min)	
Specialist's time	1.88	
Motor vehicle	0.73*	
<i>Total</i>		2.62

\*travel time per minute based on per km rate allowed by Australian tax office adjusted for travelling time to three regional centres in Queensland

Table 2. Sensitivity analysis

<b>Scenario</b>	<b>Cost conventional (\$)</b>	<b>Total cost video-conferencing (\$)</b>	<b>Variable travel cost (\$/min)</b>	<b>Break-even point (min)</b>
Base case	522	881	2.61	138
Wages +25%	653	1045	3.07	127
Wages -25%	392	717	2.14	152
Increase videoconference costs by 50%*	522	994	2.61	181
Nurse travels with doctor	436	881	3.34	133
Increased travel costs (air travel)	522	881	5.88	61
Six clinics per year	609	1178	2.61	218

## **Figure legend**

1. Break-even point at which the benefit curve (of using videoconferencing) intersects the Total Cost Curve (of face to face assessment)