

The costs of telecare and telehealth

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Introduction

Due to the pace of demographic change, we can expect health and social care expenditure to rise over the coming years (Appleby et al., 2009; Wittenberg et al., 2011). Pressure to contain expenditure, on the one hand, and to improve quality, on the other, has generated the interest of government, health and social care organisations and private industry in a group of 'advanced assistive technologies', including telehealth (TH) and telecare (TC). The Department of Health has suggested that telehealth and telecare have the potential to help manage these cost and quality pressures (Department of Health, 2005, 2010); the Whole Systems Demonstrators (WSD) pilots were funded to enhance the evidence base for both technologies. Box 1 describes the accompanying evaluation.

Box 1

The Whole Systems Demonstrator (WSD) evaluation was designed to investigate the costs and outcomes associated with two forms of telemonitoring technology – telehealth and telecare – in the context of 'whole-systems' care and support (Bower et al., 2011). The WSD telecare and telehealth trials took place within three local authority areas ('sites') in England, these areas being covered by four Primary Care Trusts (PCTs). The evaluation employed two pragmatic, cluster-randomised trials: of telehealth in a population with long-term conditions, and of telecare in a population with social care needs. The unit of randomisation was the general practice. Within each practice, eligible patients in one of the study populations (social care needs or long-term conditions) were allocated to the relevant technology (telecare or telehealth, respectively); each practice acted as a control for the other technology and eligible patient population. The WSD evaluation comprised both quantitative and qualitative research. The WSD telehealth and telecare trials drew on routine data to examine the effectiveness of these technologies on use and costs of health and social care. Administrative datasets covered the use of hospital and primary care physician services, as well as social care services such as residential and nursing home care and domiciliary care, and mortality (Steventon et al., 2012, 2013). About half of the trial participants also consented to be part of nested (WSD telecare and telehealth questionnaire) sub-studies, collecting participant-reported data on a range of outcome measures and on the use of health and social care services (Cartwright et al., 2013; Henderson et al., 2013b; Bower et al., 2011).

Qualitative analyses conducted as part of the evaluation covered the experiences of service users and carers (Sanders et al., 2012) and of professionals involved in the implementation of the technologies. Another strand of the evaluation drew on longitudinal ethnographic data to examine organisational challenges to mainstreaming telehealth and telecare (Hendy et al., 2012).

Definitions

Telecare (TC) was defined within the WSD trial as the 'remote and automatic (passive) monitoring of changes in an individual's condition or lifestyle, including emergencies, in order to manage the risks of independent living using equipment such as movement sensors, bed/chair occupancy sensors' (Bower et al., 2011). This form of remote monitoring could be classified as 'second generation telecare' (Kubitschke & Cullen, 2010), involving the extensive deployment of networked sensors and alarms, going beyond traditional 'first-generation' community or personal alarms (such as pendant or pull-cord alarms for summoning help) in remotely collecting and automatically transmitting data to monitoring centres.

Telehealth (TH) is a broad term that encompasses both 'telemonitoring' and 'telephone support': the former involves the monitoring of vital signs data by health professionals, either by being stored after submission by the patient to be reviewed later ('store and forward') or in 'real-time' (e.g. by video conferencing). Telephone support, sometimes known as telephone coaching, involves health care providers delivering support to patients or carers over the telephone system. The WSD trial defined telehealth quite broadly, as the 'remote exchange of data between a patient and health care professional(s) to assist in the diagnosis and management of a health care condition(s): e.g. blood pressure, blood glucose monitoring and medication reminders' (Bower et al., 2011).

Aims of research

Within the Whole Systems Demonstrator pilots, we sought to explore the costs and benefits of introducing telecare and telehealth in England. This short paper reports our approach to calculating the costs.

Methods

Costing method

The costing was carried out in four stages (cf. Allen & Beecham, 1993; Beecham, 2000): (i) describing the interventions in terms of their typical resource inputs and associated routine activities; (ii) calculating relevant service units; (iii) collecting cost data; and (iv) calculating a unit cost for the intervention. To develop an understanding of production inputs and processes, we collected information using a 'bottom-up' approach, involving 19 interviews (by telephone or face-to-face) with key informants and drew on correspondence with on-site WSD project teams in the three sites. We took a more 'top-down' approach to collect cost and activity data on the delivery of the intervention, using a spreadsheet-based pro forma to guide collection from project teams. These data were used to establish a unit cost, the direct cost of the telecare or telehealth package, per person per year. Unit costs were calculated based on the services as configured in 2009/10, when the majority of trial participants were recruited, in order to approximate running costs at the capacity planned by sites, rather than in the start-up phase in 2008/09. All costs are expressed at 2009/10 prices.

We aimed to establish the average costs of the interventions across the three sites. Nonetheless, the ways in which telecare or telehealth services were delivered were determined locally and not prescribed by the trial evaluation team.

A detailed picture of the services in each site was therefore the first step to understanding the inputs and processes involved in producing the interventions, examining important features of the delivery systems put in place, in terms of equipment supply, systems and infrastructure enabling the appropriate equipment to operate (assessment, installation, servers, maintenance), and monitoring and response services interacting with participants through the technology (Henderson et al., 2013a, 2013b).

As a condition of the trials, participants were not to be charged for telehealth or telecare equipment or support services. They were expected to have telephone lines and power supplies for telecare: in the case of telehealth, participants in one site were expected to have a television set. Data transmission by participants was also provided free of charge to them.

Telecare and telehealth equipment

Data on participants' telecare/telehealth equipment was provided for the evaluation by the sites' project teams, as were the prices that had been paid for the equipment. This enabled us to estimate the equipment costs for each participant. While most of the equipment was purchased for the trial, telehealth base units and most peripherals were rented in one site. In either case, we annuitised purchased base units over five years (Department of Health, 2001), while costs of purchased 'peripherals' (alarms, sensors or items attached to the base unit: e.g. blood pressure monitors) were annuitised over the same period or over the peripheral's lifetime if this information was available from sites or manufacturers' specifications. Rental charge information was provided by one site.

Telecare

Telecare users received equipment consisting of a telecare 'base unit' (Tunstall Lifeline Connect or Connect+), a pendant alarm and at least one other sensor or device. Up to 27 types of device were available for use by trial participants: for instance, 'key safes', bed sensors, temperature extremes sensors, and fall detectors. Among those participating in the WSD questionnaire study, participants received between one and eleven items.

Telehealth

Telehealth users received a base unit, that could be either free-standing or a set-top box for a television, and 'peripherals' appropriate to their long-term condition. The latter consisted of cabled or bluetoothed pulse oximeters, blood-pressure cuffs, glucometers and weighing scales, which transmitted the observations data to the base unit. A detailed description of clinical processes and behavioural regimens associated with the telehealth intervention, and breakdown by long-term condition of the peripherals provided in the trial, can be found in Cartwright et al. (2013).

Costs of supporting the delivery of the interventions

Methods for calculating support costs were similar across both interventions. Support personnel were assumed to comprise individuals working to monitor and respond to alarms/sensor alerts and to triggers flagged by algorithms in the telehealth software programmes; supervisors of these workers; and on-site WSD team managers, trainers and back-office staff. The cost calculations excluded posts/parts of posts that involved trial evaluation or recruitment. Oncosts, administrative, premises and capital overheads of directly-provided workers were calculated based on the WSD teams' information. Where sites could not provide details for calculation of administrative overheads, these were assumed to be 16 per cent of salary costs (Curtis, 2010). Other relevant costs were: server maintenance, software licences, providing free-phone numbers and data transmission from base units to servers.

Installation and maintenance costs were partly variable and partly fixed. One site had maintained a detailed breakdown of spending on these activities in 2009/10: these proportions of expenditure were applied to costs in the other sites where less detailed information was available. Fixed costs were spread over five years, the assumed lifetime of the base units, while the variable costs were taken to be incurred within 2009/10. Costs of installers, their associated overheads and of storage and transport of equipment were all taken into account. For telecare, the split between fixed and variable costs was 65 per cent and 35 per cent respectively, and for telehealth 90 per cent and 10 per cent respectively.

Telecare monitoring services and dedicated response services were provided under contract and we assumed such contracts covered the providers' costs. To obtain a yearly per-participant average cost, we divided costs of contracts in 2009/10 by the number of trial participants.

Telehealth monitoring services were calculated either top down or bottom up, depending on the components of the service. All sites had centralised monitoring call-centre teams: the costs of these directly provided or contracted central teams were calculated in terms of annual expenditure on their staff in 2009/10 (included associated overheads). However, two sites provided some monitoring services through local nursing teams (community matrons or specialist nurses): their costs were estimated from the bottom up, counting their time spent in telehealth training and in monitoring the telehealth screen. We calculated the annual total monitoring costs by applying the relevant unit costs (based on WSD project team information on NHS pay bands and local nursing team staffing complements, and including oncosts and capital, indirect and direct overheads) to the total estimated monitoring time. This latter was based in turn on the average daily screen-monitoring time (calculated using data provided by WSD project teams) of two minutes (Henderson et al., 2013b). The costs of central and local monitoring were aggregated and divided by number of study participants monitored over the year, for an average annual per-participant cost of monitoring.

We calculated the mean yearly telehealth and telecare support costs per participant (including monitoring, equipment infrastructure, installation and maintenance) and allocated those costs to participants who had received the telehealth/telecare equipment. Because the support costs were estimated mostly top down, these data did not vary between participants in the same site, although equipment cost data did vary between individual cases. We also calculated annual costs for telehealth and telecare which excluded staff posts and contracts specifically related to WSD project management. For telecare, we also calculated annual costs of support that excluded the dedicated WSD telecare response services.

Results

The total costs of supporting the delivery of telecare and telehealth varied substantially between sites (table 1). Per-participant equipment costs also showed considerable inter-site variation in the case of telehealth but not telecare.

Table 1. Costs per year across three WSD pilot sites

	Direct annual non-equipment cost of support	Support costs per participant ¹			Equipment costs per participant
		Total direct support cost	Less project management-specific posts and contracts	Less response-related contract costs	
Telecare	£170,432-£456,019	£437-£1,004	£423-£870	£408-£908	£73-£93
Telehealth	£840,464-£1,168,671	£1,134-£1,241	£804-£1,199	-	£334-£852

¹excluding equipment costs

Table 2 shows the costs per participant for the component parts for the telecare and telehealth packages; all mean costs are higher in telehealth than telecare. Moreover, equipment and support costs absorbed a greater proportion of intervention participants' total health and social care costs in the telehealth group than in the telecare group (29% vs. 9%: Henderson et al., 2013a, 2013b).

Table 2. Mean intervention costs of telecare and telehealth per participant¹

	Telecare ² mean (SE) (n=548)	Telehealth ³ mean (SE) (n=841)
Equipment and support package costs	£792 (13.4)	£1844 (10.5)
Equipment costs	£81 (1.9)	£682 (8.8)
Intervention costs	£711 (12.6)	£1162 (3.7)
- less project management posts & contracts	£608 (11.2)	£982 (6.4)
- less dedicated TC responder costs	£640 (11.5)	NA

¹ All WSD questionnaire study participants receiving telecare/telehealth equipment; annual costs of participants for whom data from self-reported cost questionnaire (CSRI) was available at baseline assessment.

² Mean annual costs for participants allocated to intervention group total sample n=1182

³ Mean annual costs for participants allocated to intervention group total sample n=1569

Conclusion

These estimations were driven by the availability of data. Support costs in both trials were estimated as average costs across service users, since more granular data on the intervention-specific service use of each participant were not available (for instance, numbers of sensor alerts (TC) or triggers (TH), types of call-centre responses to specific participants, numbers of dedicated telecare responders' visits). As data were collected in only three sites in England, the extent to which the unit costs calculated can be generalised beyond the sites should be considered when drawing on these figures. Furthermore, particularly in the case of telehealth, the costs of equipment and support associated with the trial may not well reflect future costs. New models for collecting and transmitting vital signs data using mobile phone technologies are emerging (Cottrell et al., 2012; NHS Stoke-on-Trent, 2011): one recent study reported the cost of a telemonitoring service for uncontrolled hypertension of just £71 over six months, using a combination of mobile phone and blood-pressure monitor to take and transmit readings to patients' attending clinicians (Stoddart et al., 2013).

Relatively few previous studies have provided details on the composition of telecare packages, cost of equipment and monitoring, or range of support services available to respond to sensor activations.¹ These data form an important part of the evidence base, and this clear cost estimation method driven by economic theory can help accuracy in future estimations and evaluations.

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¹ Woolham's report (Department of Health, 2005) on telecare for people with dementia gives a detailed account of the type, and amount, of telecare equipment deployed in that study (an average of 2.15 items), much of which is described as 'stand alone'. In our study, the average package consisting of 4.7 items of equipment was larger; about a third of telecare equipment items were 'stand alone'. Estimates of the cost of telecare support and equipment package in the UK have been reported as variously £7.00 per week (England) (estimated by the author using an annual equivalent cost for the equipment and annuitising over 5 years) and £9.00 per week (Wales) (Bayer & Barlow, 2010) The cost of a WSD telecare package was estimated at approximately £15 per week.

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