

Chronically Sick and Disabled Persons Act 1970

*Research and Development Work  
Relating to Assistive Technology  
2004-05*

Presented pursuant to c.44 1970 Section 22

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## **Introduction**

Several policy initiatives in health and social care over the past year have addressed the challenges posed by a changing population. More people are living into old age with greater relative prosperity than ever before. Supporting independence, self-care and choice will provide the driving force behind the development and delivery of care services over the next decade.

The research projects highlighted in this report indicate the potential for assistive technology (AT) to play its part in achieving these aims. All were funded by the Government or the European Union and commenced or reported final results in 2004-2005.

Full details of research and development projects in AT funded by Government are available on the Foundation for Assistive Technology (FAST) website ([www.fastuk.org](http://www.fastuk.org)), together with information on research funded by additional sources such as business and voluntary sector organisations.

### **New National Health Research Strategy**

In July 2005, the Department of Health published *Best Research for Best Health: a New National Health Research Strategy*. This consultation paper sets out proposals for the future direction of health research for the Department of Health and the NHS in England. The new strategy aims to create a health research system in which the NHS supports those engaged in leading-edge research to focus on the needs of the patient and the public.

### **Developments in Research Council funding**

The Research Councils, in particular the Engineering and Physical Sciences Research Council (EPSRC) and Medical Research Council (MRC), continue to provide substantial funding for AT projects. EPSRC and the Biotechnology and Biological Sciences Research Council (BBSRC) have launched a multi-disciplinary network, SPARC (Strategic Promotion of Ageing Research Capacity). SPARC aims to combine scientific excellence with a clear potential to build the capacity of the UK to conduct ageing research in the future. Support is available for ageing-related projects in areas including consumer product design and care home design.

## **National Service Framework for Long-term Conditions**

In March 2005, the Department of Health published the *National Service Framework (NSF) for Long-term Conditions*, which focuses on improving services for people with neurological conditions across England. People with these conditions will get faster diagnosis, more rapid treatment and a comprehensive package of care under the NSF. In addition all people with other long-term conditions will be supported to live as full and independent a life as possible.

Assistive Technology services feature prominently in the NSF, and the provision of equipment and accommodation is covered in Quality requirement 7. Some models of good practice support the provision of advice on using Direct Payments for equipment and vouchers for wheelchairs. This report outlines one research project which seeks to establish objective evidence to support the optimal selection of wheelchairs by users.

## **Adult social care Green Paper**

In March 2005, the Government also published its Green Paper on adult social care, *Independence, Well-being and Choice* - setting out for consultation proposals to radically reform social care for adults in England over the next 10 to 15 years. Building on the recommendations of the Prime Minister's Strategy Unit report, *Improving the Life Chances of Disabled People*, the Government proposes to increase the take-up of direct payments and to test other forms of individual budgets for people using local authority services, so that they can buy in the services they need. These include respite care, carers and technology to assist in independent living. Recommendations of the Green Paper include the development of new responsive models of care including extra care housing and telecare; and a shift to more preventative services.

A new fund for technologies to support preventative care aims to keep up to 160,000 older people independent in their own homes. The £80 million grant will be invested over a period of two years from April 2006, focusing particularly on telecare support.

Telecare can include a range of different technologies, from sensors placed around the home to detect movement, to those that monitor vital signs such as blood pressure. This report describes some of the work researching and developing telecare systems across the UK.

# **Independent living**

## **Horizon scanning**

Each year, around 30 Department of Trade and Industry Global Watch Missions are funded to enable groups of experts to investigate innovation and its implementation at first hand.

In October 2004 a Global Watch Mission visited Japan to learn and plan for predicted demographic changes in the UK. The increasing burden in Japan of pension and healthcare provision for a growing elderly population is forcing changes in long-term care policy, and a rethinking of the way long-term care services are to be provided.

Lessons learned from the Mission to Japan were disseminated through a conference in February 2004 led by Medilink Ltd and the Medical Device Faraday Partnership with support from the Department of Trade and Industry. The recommendation of the members of the Mission was that there are many lessons that the UK healthcare delivery market could learn from the Japanese experience, as well as a number of potential opportunities for collaboration in this market.

One aspect of service delivery which was noted at the conference was that the Japanese approach to supporting older people to live independently is more technology dependent than that adopted in the UK and Europe, with less focus on consultation with disabled and older people regarding the use of assistive technology. In Japan telecare is positioned as a security service with alarm systems in sheltered housing being monitored by security staff rather than health professionals.

## **Telecare**

There are currently a number of pilot projects around the country which aim to establish the evidence base for introducing telecare and AT. Pilot projects include The Columba Project in Runnymede, Surrey which supports older people in a sheltered housing scheme, the Elmington Supported Living Scheme in Southwark which used assistive technology to support six people with Learning Difficulties by monitoring daily patterns of living, and the Monmouthshire Community Alarm Service Telecare Trial which included older people with dementia, those at risk of falling, those recently leaving hospital and individuals with head injuries. Local pilot projects are primarily funded through a partnership of social services and

Primary Care Trusts with contributions from organisations including the Housing Corporation and EPSRC.

Doncaster Metropolitan Borough Council is funding a project to introduce telecare technologies throughout a sheltered housing scheme, with the aim of increasing residents' independence, social inclusion and health. The project will include formal methods to quantify what impact such a system has on users, carers and professionals. By January 2005, 31 older people living in a sheltered housing scheme in Doncaster had agreed to take part in the study. The package of equipment offered to participating residents consists of chair and bed occupancy sensors, flood detector, temperature extreme, fall detector, automatic lights when getting out of bed, epilepsy sensor, a wandering alert, and a lifestyle monitoring package. The lifestyle package consists of movement detectors, door usage (on fridge, food cupboard and cutlery door), and electrical usage (on kettle, toaster and TV).

Wardens initially found it difficult to come to terms with the new technology resulting in the need for considerable on-site support from the project team. Interim results suggest that, compared to the control group, participants in the intervention group feel safer at home, have improved social functioning, and maintained or improved their ability to stay living at home.

There is a great demand for practical information on the benefits of telecare. One project that is notable for taking an active role in sharing information is the People at Home and in Touch Project which involved Durham County Council, local District Councils and five NHS rapid response teams. Partnerships were built up between different organisations in the public and private sector resulting in benefits to the 50 clients involved, who reported a better quality of life and greater social inclusion.

Although the project ended formally in March 2004 it has resulted in a major annual conference; the fifth conference was held in Durham in October 2005, bringing together experts in AT and telecare. The conference disseminates information on how AT, telecare sensors, telemedicine, intelligent monitoring systems, and information and communication technologies are being used in projects throughout the UK.

The Department of Trade and Industry (under its Technology Programme) and the Department of Health have recently agreed to contribute to the funding of a large multi-partner project in telecare. The project, which builds on earlier work funded under the Next Wave Technologies and Markets Programme will develop a novel

architecture for unobtrusive pervasive sensing to link physiological/metabolic parameters and lifestyle patterns for improved well-being monitoring and early detection of changes in disease.

### **Activity monitoring**

A pilot project to trial a new assistive technology designed to maintain the independence of older people commenced in August 2004 and is being undertaken by Hampshire County Council and Vivatec Ltd. The Vivatec Wristcare uses a device similar to a wrist watch to gather activity information about the wearer. The aim is to reduce the number of hospital admissions for emergency care by providing detailed information on the wearer's movement and sleep pattern over each 24-hour period. This will allow interventions to be put in place before the wearer experiences a fall or other medical emergency which might require hospitalisation.

The device can also be used by older people with dementia who have a wandering problem. As the device allows greater flexibility than the existing door sensor type devices, allowing people to move within a greater radius from the base unit before triggering an alarm, the units should enable the wearer to retain some independence while maintaining their safety.

The original project was planned with 12 month duration. However, the project is now ongoing for the foreseeable future. Preliminary results reported in Summer 2005 show that the project helped older people to remain at home and saved unnecessary costs by preventing admissions to hospital. WristCare is providing reassurance to the people wearing it, contributing to their well-being, and at least on one occasion the activity data has flagged an emerging health problem which was dealt with before it became an emergency.

### **Mobile alarm and information systems**

EU member states and industry are investing heavily in extending the capability of telecare products to maintain the independence of older people. The MobilAlarm Project (Validating European Mobile Alarm Services for Inclusion and Independent Living), funded by the eTen European Community Programme, is looking at how efficiencies can be achieved by implementing a mobile alarm service on a European scale.

Project partners report that across the European Union many older people are connected to a location-dependent alarm service. Market

research indicates that the numbers of people using alarm services will rise dramatically over the next few years and the project team suggest that a location-independent alarm service may help to increase independence for these older people.

MobilAlarm started in March 2004 and will examine over 18 months the technical and financial viability of a location-independent, trans-European alarm service. The aim is to enable older people, chronically ill and other people at risk, to initiate an alarm call whenever and wherever in Europe they need or wish to do so. Project staff will test the available technology, develop a business plan and set up trials where the alarm system can be tested. Attendo Response Ltd, located in Rotherham, is a partner in the project.

### **Independence for people with dementia**

Dementia progressively undermines an individual's cognitive, social and functional activities of daily living. The pervasive short-term memory problem makes challenges of even the simplest tasks as people continuously forget what they are doing, what has just been said and that they have started tasks, such as boiling the kettle. Consequently, dementia is disempowering as relatives and professional carers step in and gradually take over all aspects of a person's life. This is also challenging for those providing care as keeping people with dementia safe and occupied is a stressful and demanding task. Finding a way for people with dementia to engage in stimulating and enjoyable activity on their own would be beneficial both to them and also to their caregivers.

Researchers at the School of Psychology at Dundee University have been funded for three years from October 2004 by EPSRC to take forward their findings from the CIRCA (Computer Interactive Reminiscence and Conversation Aid) project which has been featured in previous Section 22 reports. CIRCA developed a touch screen computer tool which enabled carers and people with dementia to actively explore together a multi-media reminiscence programme.

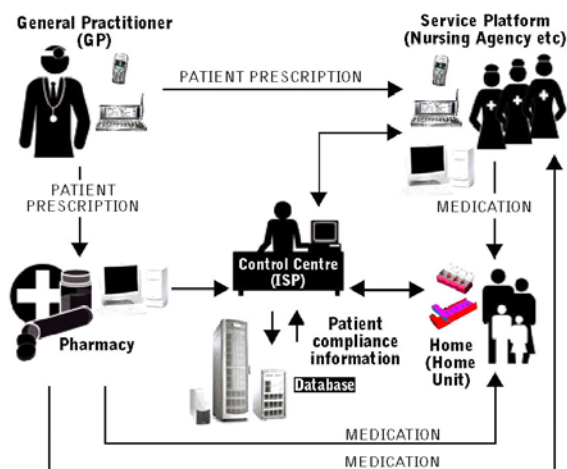
The Living in the Moment project takes this idea forward with the aim of developing a computer generated interactive experience that people with dementia can use on their own. The research challenge is to discover ways to engage and involve a person with short-term memory impairment over a significant time span, by providing appropriate prompting and supportive interaction.

A number of 3D virtual environments are currently being developed, including a tour of Dundee's McManus Galleries, a 'virtual' pub, and a walk around the Botanic Gardens. The team is also collaborating

with the University's Institute of Sport and Exercise to investigate adding virtual sporting and exercise experiences. It is hoped that the result, which researchers believe will be a significant benefit to people with dementia and their carers, will also further understanding of the cognitive processes and interactive possibilities for a person with short-term memory impairment.

### Healthcare support for independence

Many illnesses are treated using orally-administered medications. Despite this prevalent use, people frequently fail to take their prescribed medication correctly (non-compliance). As the size and age of the population increases, so too does the level of non-compliance. The MEDICATE project (the control, identification and delivery of prescribed MEDICATION) was funded by the European Union and ran from January 2001 to October 2004, led by the Faculty of Engineering at the University of Ulster. The aim was to develop a device and supporting system for dispensing drugs that could help prevent non-compliance. The device was designed and developed based on a study of the factors which lead to low levels of compliance by people taking prescribed medicine.



The MEDICATE dispensing device is connected to a dedicated control centre using the internet. This allows health professionals to access information about whether a person has removed the correct medicine from the device. It also allows an emergency response to be activated if the information gathered indicates that critical drugs have not been removed from the device.



Findings from the project have demonstrated that using the MEDICATE device can assist health professionals to support a person who consents to the intervention to manage their medication regime at home.

# Mobility

## Driving and safety

The Mobility Advice and Vehicle Information Service (MAVIS) is an agency of the Department for Transport providing information and advice to disabled motorists. Working in partnership with the Motor Industry Research Association and Dean Southall Consultancy, MAVIS funded a project, starting in October 2002, to examine the effects of steering adaptations on car control.

The project examined available steering adaptations and compared vehicle handling performance against handling performance of standard vehicles. Driver performance, accuracy, confidence and comfort were measured using a range of steering adaptations. The results of this project will be used to inform standards and codes of practice for vehicle adaptations in the UK and Europe. The project ended in February 2005 and the final report, providing a range of recommendations on system design, selection and user training will be publicly available in Autumn 2005.

MAVIS has also been working since November 2002 with the Ergonomics and Safety Research Institute at Loughborough University, the Motor Industry Research Association and the Derby Disability Equipment Assessment Centre on a project examining the seating and stability of disabled drivers. This project ended in January 2005 and findings are due to be published in Autumn 2005.

While there was little difference between the driving performance of non-disabled drivers, those with disabilities using standard controls and those using hand controls, it was evident that disabled drivers, particularly those using hand controls, required considerably more effort to maintain the same level of performance, resulting in increased fatigue. Seating systems did improve performance to some extent in most groups, but their main benefit was to reduce the effort required by disabled drivers to brace themselves while driving, reducing fatigue.

The research has resulted in the production of guidelines for assessment which will be issued to the Forum of Mobility Centres for comment and trial. Guidance is also being produced for disabled drivers and for adaptation firms.

## **Optimal wheelchair selection**

Although the evidence in favour of improving quality and flexibility of wheelchair provision for spinal injured and other users is intuitively strong, researchers at the Aspire centre at the Royal National Orthopaedic Hospital at Stanmore have noted that the evidence lacks objectivity and has failed to change practices in the majority of wheelchair services.

The Aspire team have been funded by the Community Fund and NHS Wheelchair Services to establish objective evidence to support prescription of the optimal wheelchair for a user. The measurement methods that are being used in the WOWSUP (Workshop for Optimisation of Wheelchair Selection and User Performance) project form part of an international initiative to understand and reduce the impact of a lifetime of wheelchair use on the musculoskeletal structures of the arms and shoulders of wheelchair users.

A protocol for quantitative assessment of wheelchair selection and user training has been developed that is inspired by the techniques used in gait analysis. A qualitative measure of wheelchair propulsion performance is also being developed that could be implemented in day-to-day clinical situations. Project results are due for publication in 2006.

## **Technology to assist communication**

### **Hearing to enable communication**

Children who have difficulty hearing, for example in the classroom, may have a 'brain hearing' problem called auditory processing disorder (APD). This means that they have difficulty making sense of the messages sent to the brain from the ear but may have otherwise normal hearing. Exactly how common this problem is has not been established, but some experts think that many children who have dyslexia may also have APD. One difficulty to be addressed is to distinguish between a hearing impairment, an auditory processing problem or other processing problems in the brain. Assessment needs to be appropriate and engaging to young children.

The Computer Games to Assess Children with Listening Problems study is being funded by the MRC and started in August 2004. The research team has examined the different tasks and tests needed to assess a child with suspected APD, and created a computer game to engage the children in these tasks. Wearing earphones, they make selections in the game depending on the sounds they hear.

The research team is examining data gathered from a sample of around 60 children from 6-11 years old. The next step will involve a shorter test involving a larger sample of children. It will then be possible to comment on the prevalence of APD, produce a commercial diagnostic package and examine the incidence of learning problems with APD.

The response of the cochlear nerve (the nerve of hearing) to acoustic stimulation (sounds) in a non-hearing impaired ear includes a random element (noise) that researchers believe may be an essential part of hearing. Cochlear implants are used to restore the hearing of profoundly deaf people and work by electrically stimulating the cochlear nerve. Studies have shown that an element of noise added to sound signals can increase the amount of information transmitted by models of the cochlear nerve.

A project funded by EPSRC has developed a new coding method for cochlear implants called SDN (Signal Dependent Noise). Combining the heard sounds with an additional noise source may lead to an improvement in the information transmitted to the auditory centres in the brain via the cochlear implant. A patent application has been made to cover the Signal Dependent Noise Coding Strategy. A new project, Multiplicative and Fractal Noise Coding for Cochlear Implants, starting in April 2005 and funded by EPSRC for three years, is refining the technique to improve speech comprehension.

### **Augmenting communication**

Funded by the NHS NEAT (New and Emerging Applications of Technology) programme for three years from December 2004 and led by the Speech and Hearing Research Group at Sheffield University, the VIVOCA (Voice Input Voice Output Communication Aid) team aim to develop a portable communication aid which can translate relatively unintelligible speech into clear speech.

Initially the project will concentrate on people with moderate to severe dysarthria, who have difficulty in controlling and co-ordinating the muscles used in speech. The device will translate the speech of a dysarthric person into clear speech output (synthesised or recorded). The research team hope that this will be useful to people when they wish to interact with non-familiar communication partners at work, when shopping, in the hospital, on the telephone, or in other situations.

VIVIOCA will also examine the means of allowing the aid to be portable (including body-worn), which should help natural face to

face communication. The project intends to develop techniques for adaptation as the speech and needs of the user change over time, which may benefit people with progressive neurological conditions such as Motor Neurone Disease.

## **Tactile Communication**

The Government is aiming to make all public services available electronically. Computer technology can greatly increase a Deaf-Blind person's access to information and their ability to communicate with other people.

Despite increasingly accessible communication and information available through the internet, commercially available systems that allow visually impaired or Deaf-Blind people to interpret electronic information and communicate via a computer-controlled tactile interface are expensive and display a limited amount of information in Braille format only. There is a danger that the rapidly growing influence and use of internet technology may increase and exacerbate the isolation of Deaf-Blind people.

To address the need to produce a tactile device with a wide range of uses that would be low cost for market acceptance, the Tactile Communication Systems for Persons with Combined Auditory and Visual-Impairment (Deaf-Blind) project was funded under Round 3 of HM Treasury's "Invest to Save" Program Budget and led by the Department of Health, QinetiQ Ltd, City University, and Deafblind UK, with advice from the Royal National Institute of the Blind (RNIB).



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The aim of the project was to develop a device which could display a wide range of information, such as text, graphs, charts and images in an easily useable format for users, and to produce the device at a sufficiently low cost to enable wide-spread take up.

The technology may enable greater social inclusion and independence for blind and Deaf-Blind people with a positive impact on their ability to gain employment.

A tactile device was constructed to display 30 Braille characters, or 12 alphanumeric, Moon code or graphic symbols. These are selected using a software interface which runs on a standard computer. The

device creates the desired Braille, text or symbol shapes, which refresh automatically using pins raised and lowered through a rectangular grid of holes.

## Rehabilitation

### Support for walking

The high and growing incidence of hip fractures in the older population has become a cause for concern. Successful rehabilitation depends on starting to walk as soon as possible following the fall. However, it is difficult to implement early walking rehabilitation because of surgical complications in treating the fracture, or because of a person's reluctance to fully weight bear after an operation.

Researchers at the Orthotic Research and Locomotor Assessment Unit (ORLAU) at the Robert Jones and Agnes Hunt Hospital, Oswestry, with funding for a one-year pilot project from NEAT, aimed to demonstrate that use of a rear support walking frame is safe in a wide variety of environments.



The concept device enabled the research team to ensure they could get older or disabled people safely into the frame and that the users would be comfortable using the frame without the support of an orthosis. The biomechanical data gathered confirmed that it would be safe to trial such a system on selected individuals in a future extension of the work. Plans for trials are now being developed and researchers are investigating means of providing real-time monitoring of the degree of weight relief provided during supported walking.

### Rehabilitation and risk

The health related benefits of walking for disabled people are widely accepted. The introduction of the Manual Handling Operations Regulations has led to a profound change in attitude to the task of transferring patients and significantly reduced the potential for injury to carers. However, it has also impacted on the therapeutic

and functional benefits for disabled people which can be gained by walking.

The Department of Health funded a project led by ORLAU examining transfer of ambulatory patients who are severely disabled. This established the necessary requirements for enabling people using walking orthoses to be transferred conveniently and safely. In addition, the team have designed prototype hoisting straps for walking orthoses, a transfer frame for reciprocal walking orthoses and a guidance document for transfer of ambulatory patients.

Outputs from the project include instrumentation developed to allow the effort involved in transfer to be monitored for comparative purposes. A manual has been drafted and ORLAU are discussing the most effective way to distribute the information with the Department of Health and the Medicines and Healthcare products Regulatory Agency (MHRA).

## **Technology Evaluation**

Due to a rising awareness of the need to justify expenditure with reference to a credible evidence base, there are an increasing number of projects using research methodologies to evaluate the performance of current assistive technology. Evaluation of existing products is often the first step towards developing a new product.

### **Technologies for hearing**

A research team at Guy's and St Thomas' NHS Foundation Trust examined the benefits to children of using of a digital hearing aid in their non-implanted ear in addition to the cochlear implant which they were using in their implanted ear. A group of seven children who used a single cochlear implant participated. The team found that the children performed better with the combination of a cochlear implant and hearing aid.

The research resulted in several recommendations regarding the fitting and assessment of a cochlear implant and a hearing aid which included adjustment and balancing of sound amplification between the two devices, the importance of making parents aware of the potential benefits of using both devices together, and the need for clinics to provide trials on request. The research was funded by the NHS and ended in December 2004.

## **Technologies for vision**

A project led by Central Manchester and Manchester Children's University Hospitals NHS Trust, with funding from the NHS, looked at the relative benefits of using spectacle mounted autofocus low vision devices compared to a hand held device.

An article reviewing the project was published in the British Journal of Ophthalmology in November 2004 and showed that using an enhanced low vision rehabilitation model (spectacles) was no more effective than conventional low vision rehabilitation (hand-held device).

The same team from Manchester led a randomised controlled trial looking at alternative devices to low vision aids such as magnifiers which most people use if they have age related macular degeneration. The research team's proposal, which they were able to explore with funding from the NHS and Guide Dogs for the Blind, was that prism spectacles could provide a realistic alternative to traditional low vision aids. Prism spectacles effectively use areas of the retina which are unaffected by macular degeneration. However, the research found that prism spectacles are no more effective than conventional spectacles for people with age-related macular degeneration.

## **Technologies for continence**

More than half the £206 million UK market for pads and appliances for intractably incontinent people is spent on absorbent bedpads. Pads have improved greatly in the last decade but they still leak frequently, leading to embarrassment, discomfort and extra laundry work.

Current development work uses a trial and error approach, which is time-consuming and costly. Evaluation is by simple laboratory tests whose relationship to real life performance of the pads has not been demonstrated. Researchers at the Continence and Skin Technology Group at University College London were funded for a year by EPSRC to explore their proposal that predictive mathematical models were needed to aid the development of new incontinence bedpads.

The research team created a predictive model for the spread of fluid in reusable bedpads. The model concentrates on two-dimensional infiltration into a bedpad modelled to replicate a real life situation where the pad is rumped and not lying completely flat.

## **Technologies for mobility**

Independence Technology launched the INDEPENDENCE® iBOT® 3000 wheelchair in 2003. The iBOT incorporates technologies for stair climbing, rough terrain and mobility at normal standing height. The Aspire Centre for Disability Studies undertook a comprehensive outcomes study of the iBOT to determine how effectively these features overcome access problems for wheelchair users, and the extent to which a requirement for home modifications can be reduced by its features.

Information was gathered from the computer onboard the iBOT which records usage information, and also from user and carer questionnaires. Results indicate that participants used the iBOT very differently in a range of environments, but generally perceived an improvement in their quality of life.

## **Evaluating audit of technology use**

The Audit Commission Report *Fully Equipped* identified that there is inadequate clinical audit of equipment. Information on the use of equipment is crucial to enable an evaluation of the usefulness or otherwise of equipment provided to people in their own homes where usage is not monitored.

The NHS NEAT programme funded a one-year project to develop an orthosis monitoring system. The objective was to prove that routine low-cost monitoring of rehabilitation devices, primarily orthoses and external prostheses, can be achieved conveniently and unobtrusively.

A prototype data logger to monitor the use of equipment in a clinical setting has been produced. This permits the frequency and time of use of equipment to be monitored over a twelve-month period. It is attached to the device and records usage information.

Clinic staff found that the device was practical and enabled a wider range of data to be recorded. Patients were questioned about the monitoring equipment and none were disturbed by the application of the device to their orthotic system.

Project funding finished in August 2004 and a working prototype, ready for commercial development, was produced. A new housing for the electronic components has now been designed, and production development and rapid prototyping techniques have led to a 40 per cent reduction in the size of the assembled logger.

## **Evaluation programme**

Until April 2005, the MHRA was responsible for commissioning an evaluation programme of medical devices, including assistive technology. The Device Evaluation Service has now transferred to the NHS Purchasing and Supply Agency (NHS PASA), becoming the Centre for Evidence-based Purchasing.

Evaluation reports published in 2004 include:

- Memory Aids, December 2004
- Standing frames for 8 to 14 year olds, December 2004
- Specialist computer controls: alternatives to the standard keyboard and mouse, September 2004
- Pressure reducing overlays, June 2004
- Pressure reducing mattresses, April 2004

These documents are available on the Centre for Evidence-based Purchasing website at [www.pasa.nhs.uk/cep](http://www.pasa.nhs.uk/cep).

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