Could you outline the main objectives of your research on developing new information technology solutions to decrease falls in the older population?

Fall prevention is a huge challenge in the older population. New information and communication technologies (NICTs) are tools that could be helpful in fall consequence prevention, such as prolonged station on the ground or psychomotor post-fall syndrome. Physicians regularly prescribe telecare, but few studies have addressed its impact in a primary or secondary preventive role. The objective of my first pilot project (ESOPPE in 2010) was to explore home-based NICT impact on the reduction of falls or fall-induced hospitalisations in a cohort study of elderly people living at home.

How did you first become interested in tele-assistance for older people and to what extent have your research interests evolved throughout your career?

As a geriatrician, in my daily clinical practice I noticed that many elderly people were admitted to emergency rooms or geriatric units following a fall. We found that about half of these hospitalisations could have been prevented if patients had been rapidly helped up and if their living environment had been adapted to account for neurosensory ageing. The first NICT to be implemented at home was the personal emergency response system (PERS), although this was used without any clinical evidence of efficacy.

Since this time, my research interest has enlarged to study how we could develop home-based NICTs. I have been exploring the acceptance of these tools by older individuals and making a medicoeconomical assessment of their impact. For this purpose, I created a research and gerontological public health network dedicated to the prevention of age-related chronic polypathology deterioration called the Unit for Prevention, Monitoring and Analysis of older people (UPSAV). More than 3,000 individuals are followed-up by this network providing exhaustive global assessments and preventive intervention.

To what extent do elderly individuals who fall represent a burden to health and social care systems?

One in three people aged 65 and over, and one in two aged over 80, fall each year. The medicoeconomic consequences are tremendous; the global cost of falls is estimated to be €2 billion in European countries such as Germany, France and the UK. Additionally, falls are a risk factor for the development of dependence, the cost of which is estimated to account for 0.5 to 1 per cent of the GDP of industrialised countries. That’s why I developed different studies to focus on the preservation of independence amongst elderly individuals.

In what ways do older people, their families and caregivers respond to the implementation of NICT intervention systems?

People often think that elderly individuals are ‘technophobic’; our studies suggest that this is not true. Sociological interviews have emphasised that older people have lived through several technological and industrial revolutions, which makes them open to another one! What they want is to understand the
Ageing creates a variety of lifestyle issues for an individual. What were once simple actions begin to involve more risk and have more severe consequences when they go awry. Such reduced physical capacity is unfamiliar to affected individuals and can lead to a more negative mental state. Perhaps the epitome of the ageing process is the potential consequence of a simple fall. Falling can, of course, cause impact injury through cuts, bruises and broken bones; however, these are rarely the most serious result. Often, if alone, an elderly person will struggle to raise themselves up off the floor, and a prolonged grounded period can lead to a variety of problems: rhabdomyolysis, the breakdown of muscle tissue into the bloodstream, for example, is one major issue faced by those who may have initially acquired non-lethal injuries. Metabolic disturbances can also arise from lying prone for an extended length of time, and there is a possibility of developing both hypothermia and inhalation pneumonia. All these are serious health issues that will usually require hospitalisation.

Aside from these physiological problems, there is a real risk that the person may develop significant mental health issues. The post-fall syndrome will generally constitute an understandable fear of falling again; however, there is also a risk of suffering from neurosensory and cognitive deregulation that makes walking more difficult. Additionally, there is a chance of developing memory impairment and, more generally, depression. These psychological problems can be dealt with readily through rehabilitation; however, it may take time before someone seeks help or is diagnosed. Issues associated with falling are even more severe when faced by individuals with Alzheimer’s disease. Neurodegeneration worsens age-related neurological deterioration and anxious patients often wander, thereby increasing the risk of falling.

In order to help prevent and manage the physical and psychological consequences of ageing, new information and communication technologies (NICTs) have been developed to aid the elderly in their daily lives. Physicians at the University Hospital of Limoges, France, have been conducting in-depth studies into the effect of personal emergency response systems among ageing populations.

How do the results of your various trials inform your future plans?

Thanks to these results suggesting a general acceptance of NICTs, the regional health agency decided to expand telecare to a large number of older people. We will be able to assess the medicoeconomic impact on a larger scale and, in the UPSAV cohort follow-up, are seeking to establish independence preservation during ageing. This will enable new intervention studies with NICTs to prevent loss of autonomy, on which I am currently collaborating with Professor Lewis Lipsitz at Harvard University, USA.
technologies (NICTs) are being developed. These are designed to help reduce the chances of falling and increase the speed at which accidents are resolved. To date, there has been little research conducted into the effectiveness of these devices in aiding older people. Professor Thierry Dantoine, Head of Internal Medicine and Geriatrics Services at the University Hospital of Limoges, France, has been conducting several in-depth studies to address these unknowns.

**ASSESSING AGEING**

During his work as a geriatrician, Dantoine identified that a lack of information concerning NICTs and personal emergency response systems did not allow for an adequate assessment of risk. This led him to investigate new methods to reduce the probability of elderly individuals requiring hospital treatment for preventable falls and accidents. This work not only impacts the quality of life of older patients, but also the cost of geriatric healthcare. “Our studies are important for understanding whether NICT-based prevention mechanisms allow cost savings as well as improvements to patient care,” Dantoine elaborates.

So as to better grasp the medico-socio economic issues at play, Dantoine has created a public health network that monitors and assesses elderly people. This is the Unit for Prevention, Monitoring and Analysis of older people (UPSAV) – the mobile gerontological network for the prevention, follow-up and analysis of ageing at home. UPSAV has conducted several related studies in the field, these include the ESOPPE study, DOMOLIM, GET-BETTER, TELEHPAD, GEROPASS and e-COBAHLT projects which have been instrumental in forming Dantoine’s ideas.

**EXAMINING THE ELDERLY**

While all six have been conducted under the scope of UPSAV with similar and overlapping elements, they each provide a novel insight into the impact and effectiveness of NICTs. “I chose to rely on exhaustive face-to-face assessments of people in real living circumstances to obtain the most accurate evaluation of their state of health and autonomy,” explains Dantoine.
The ESOPPE study was the preliminary work that aimed to analyse the effect of these technologies on fall risk. Dantoine and his team found that such devices are capable of reducing not only fall risk, but also the serious risk of the incident. Alongside this, the researchers tested whether NICTs were cost-effective. He was able to show that investments in technology was recouped within 17 months of its installation.

In order to confirm the results of the ESOPPE study, Dantoine is conducting a large, randomised trial called DOMOLIM, which includes 1,200 people aged 65 years and over who live at home. This will lead to examining the effectiveness of particular technologies within the scope of his investigations.

Two further projects are aimed at assessing the effectiveness of automated remote monitoring systems in both a medical and economic sense. The TELEH-PAD study – testing cameras coded with algorithms to send alerts to carers should any dangerous situations arise – currently involves 216 nursing home residents, whilst the GET-BETTER study features 360 hospitalised patients with Alzheimer’s disease. If the results confirm the utility of NICTs, then further development of such technologies would require a reorganisation of geriatric healthcare provision.

In conjunction with these studies into the medical and economic benefits of NICTs, the researchers have been looking into how such technologies could be used to prevent the functional decline of autonomy. The GEROPASS study utilises coordination software (e-Geropass) to facilitate communications between older individuals and their carers.

Finally, another ongoing project is the e-COBALHT study, which aims to evaluate the medical, social, economic and organisational impact of home-based technologies and telemonitoring; particularly, it is looking to address the acceptance of NICTs. Both e-COBALHT and GEROPASS are ongoing and results will be available soon.

A BRIGHT IDEA
These studies have allowed Dantoine to develop and test his own device for reducing fall risk at night by addressing neurosensory ageing effects. Ageing induces the dulling of proprioceptive sensitivity that complicates walking in the dark and induces dazzling when the lights are turned on at night. Balance reactions are also slower in elderly individuals. Together, these factors make getting up at night high risk activity.

The light path is intended to guide a person from the bedroom to several key rooms, primarily the bathroom and kitchen. This is achieved through the placement of lights – that are motion activated – at an even distance along these pathways, meaning the person does not need to continually find light switches in the dark. Additionally, the device produces light at an intensity that is sufficient to indicate the way whilst not dazzling. Through his studies, Dantoine has found that light paths are able to significantly reduce the incidence of falls. As well as helping to maintain health and autonomy, this also translates into economic benefit as the costs associated with installing such a device are quickly compensated by a reduction in emergency responses and hospitalisations.

FALLING RISK
Dantoine’s studies show there is significant potential in NICTs for aiding older people. Benefits are not limited to medical care and also include an increase in quality of life and cost-effectiveness. Combined with his own contribution to such technologies, it is clear that Dantoine is providing valuable resources for geriatric medicine. This has been recognised by the local authorities with which he works, and they are now expanding the coverage of personal emergency response systems and other NICT devices.

The utility of this work is also being recognised outside of France; Dantoine intends to collaborate with medical professionals in the US. For the focus of his next project, in partnership with Professor Lewis Lipsitz at Harvard University, USA, Dantoine hopes to gain greater insight into the autonomy of elderly people. Working with patients, scientists, engineers and doctors, he is creating a ‘living lab’ in order to bring extensive studies into the field.

TELECARE FALL PREVENTION AND AUTONOMY PRESERVATION

OBJECTIVE
To explore the effectiveness of home-based information and communication technologies for fall prevention among the older population.

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