

The ageing population

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Biomedical engineering creates new medical technologies and systems that can greatly improve patient care and quality of life. The UK Focus for Biomedical Engineering is the Academy's forum for this increasingly important area of engineering in which the UK is taking a lead.

Introduction

The UK's population is ageing. More of us are living into old age, and that number is going to increase yet further. The consequence of this will be a big rise in the incidence of illnesses that afflict the elderly in particular and increased demand on healthcare services as diseases and events that would, in the past, have often been fatal become survivable.

The implications of an ageing population are serious for health services. Engineering will have a strong role to play in mitigating and managing the effects of this surge in demand for healthcare and in enabling care to be delivered in new ways and independence to be retained.

Background

Currently, 16% of the population is over the age of 65, with 19% under the age of 16. By 2034, these figures are set to change, with 23% of the population projected to be over the age of 65 and just 18% under the age of 16. The fastest growing age group is projected to be those over the age of 85 (also known as the 'oldest old'). Currently there are 1.4 million, but this is forecast to increase to 3.5 million by 2034.

An ageing population will lead to an increase in such illnesses as dementia and diabetes. In the UK today, 700,000 people are affected by dementia. This number is expected to double within a generation. Dementia currently costs the UK economy £20 billion per annum and a 2008 King's Fund study projected a rise to £50 billion by 2038. There are 2.6 million people in the UK with Type 2 diabetes and this is expected to increase

to 4 million by 2025. The costs of diabetes are high because of associated complications such as heart disease, stroke, visual impairment, kidney disease, nerve damage and amputations.

Three-quarters of social services costs related to diabetes are associated with residential and nursing care, while approximately two-thirds of people with dementia live in private households; the majority of their care is provided by family supporters and primary and community care teams.

Other major illnesses that affect older people include cancer, Parkinson's disease and strokes. Every year in the UK approximately 112,000 people over the age of 55 suffer a stroke and many of these people live for many years with the associated disabilities. Those over the age of 75 have a significantly greater risk of accidental death, with falls the most serious risk. For older people across the age ranges, it is important to support healthy ageing to enable people to remain independent and able to live in their own homes as long as possible.

The role of engineering

Engineering underpins many of the actions required to improve the quality of life of older people, including medical, social and infrastructure needs. As well as enabling advances in medical technology, engineers are helping to provide a clear vision for building homes and communities with the ageing society in mind. They are also actively working to improve the transport infrastructure so that independence and socio-economic activity can be enhanced in old age.

The availability and cost of care accommodation is of major concern and puts the emphasis on using technology to maximise independence at home, which is both cost-effective and what people want. The assistive technologies available range from simple bathing aids through to sophisticated sensor systems. Assisted living is defined as an arrangement for people with special needs, particularly older people with disabilities, that provides help with everyday tasks such as bathing, dressing and taking medication.

Even the simplest interventions can be cost effective. For example, it costs just £8.50 to provide a raised toilet seat and this can obviate the need for a home care package costing £100 per day. A walking frame that costs £50 can prevent a fall and even an emergency admission to hospital – and between 30 to 50% of people experience at least one fall in their lifetime after the age of 65.

Assisted living technologies reduce the need for residential care where a bed costs £300 to £400 per week. Nursing care is even more expensive. Telecare, home-based devices and services that support daily life with a remote link to a call-centre, and telehealth – remote monitoring, consultation and diagnosis – are all part of assisted living technology that can help support independent living at home, keeping potential patients out of hospital and residential care.

Advances in sensors and in intelligent control systems are allowing the development of remote care or assisted living so people with dementia or long-term conditions can remain in their own homes.

Assistive technologies

The assistive technologies that involve engineering and that help people to retain their independence are categorised according to three levels of need:

- **Empowerment** involves monitoring health through the use of technologies – such as a blood pressure monitor to keep blood pressure below dangerous limits.

This group of technologies can be used at all stages of life to promote a healthy lifestyle. It includes telemedicine, monitoring devices and “smart clothing” – integrating sensors into fabric, a technology that is expected to be widely used in the future.

Rapid developments of mobile phone technology are making it simple to transmit data to personal databases or health professionals. This could be a major force for driving a healthy ageing agenda. The benefits of these technologies are that they are generally unobtrusive and easy to use. They also provide better healthcare at minimal cost and can adjust to lifestyle factors such as diet and exercise.

- **Support** technologies can restore almost complete independence. These developments cover simple devices such as spectacles, contact lenses and hearing aids through to sophisticated implants.

Further examples of supportive technology include: surgical/medical procedures such as joint replacements; incontinence support such as garments, catheters and surgical solutions; neuroprostheses such as sensory devices for vision and hearing that can substitute for the function of an ear drum; and interactive devices using GPS and mobile phone networks to provide accessibility to information in public areas.

Inclusive design reduces stigma, as the individual has better accessibility to complex information and quality of life can be maintained. Studies by the National Institute for Health and Clinical Excellence (NICE) have demonstrated the cost effectiveness of total joint replacement (where a whole joint is replaced by an artificial joint) and further research and development will lead to longer wearing replacements for a wider range of joints.

Of particular importance is the routine use of inclusive design of the built environment and home appliances. In many cases, this may be as simple as ensuring that information displays are user friendly; other engineering challenges centre on accessibility,

weight, portability of domestic appliances such as kettles, and safety.

- **Dependency** is the point where an individual becomes dependent on a range of technologies for continued assisted living at home. These devices and systems are aimed at the rapidly growing need to maximise the independence at home of people with long term chronic conditions, especially those with cognitive impairments associated with dementia.

This area presents the greatest technical challenge but also offers the greatest potential financial benefits by minimising the numbers of people who will require care accommodation. Technology has the potential to allow many people's medical conditions to be managed in the community.

Examples of technologies to address dependency issues include smart homes (the integration of technology and services through home networking for a better quality of living), using surveillance systems, intelligent appliances, sensors and mobility aids.

People in this group are predominantly those with dementia and for whom everyday life and routine tasks are difficult. Advanced sensors and communication systems are being developed to monitor activities such as time in bed and time between movements within the home. Sensors that can detect falls and monitor vital signs are also used.

Future work

Engineering has a key role in helping to deal with the challenges of an ageing population with a need to focus on several priorities:

- **Inclusive design.** An inclusive design approach to infrastructure, home environment and appliances is essential. This entails an understanding not only of physical limitations but also of cognitive aspects.

- **Matching of solutions and technologies.** A wide variety of assistive technology is available, but there is evidence that 23-40% of the equipment supplied is never used. This commonly arises because of inadequate data on the environment and detailed needs of the user.

- **Maximising mobility** is central to independence and, for a large

proportion of the UK's population, is achieved by the use of a private car. While many older people continue to drive, relatively little is known about the requirements of the older driver. We need better understanding of the effects of visual impairment, increased reaction time, reduced physical strength and personal mobility. Public transport is generally poorly accessible to elderly and disabled people. Improved information systems are also necessary to reduce waiting times and delays in physically uncomfortable and potentially unsafe places.

- **Development of telehealth and telecare approaches.** Telehealth, which allows the easy collection and transmission of important physiological parameters, can play a major part in the promotion of healthy ageing and in the remote monitoring of pathology. Telecare, when IT methods can be used to monitor the life and safety of an older person living at home, is a vital component in the development of assisted living solutions.

Conclusion

Engineering has a vital, underpinning role in improving care and support for older people in a rapidly ageing population. The Royal Academy of Engineering is active in the field of biomedical engineering through the UK Focus for Biomedical Engineering. The group produces policy papers, organises briefing seminars and engages with the policy community to promote awareness of new technologies, their applications and implications for the delivery of healthcare.

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