

# Residential and nursing homes: how can they meet the challenge of an aging population?

Szczepura, A.

**Author post-print (accepted) deposited by Coventry University's Repository**

**Original citation & hyperlink:**

Szczepura, A 2011, 'Residential and nursing homes: how can they meet the challenge of an aging population?', *Aging Health*, vol. 7, no. 6, pp. 877-887.

<https://dx.doi.org/10.2217/ahe.11.79>

DOI 10.2217/ahe.11.79

ISSN 1745-509X

ESSN 1745-5103

Publisher: Future Medicine

**Copyright © and Moral Rights are retained by the author(s) and/ or other copyright owners. A copy can be downloaded for personal non-commercial research or study, without prior permission or charge. This item cannot be reproduced or quoted extensively from without first obtaining permission in writing from the copyright holder(s). The content must not be changed in any way or sold commercially in any format or medium without the formal permission of the copyright holders.**

**This document is the author's post-print version, incorporating any revisions agreed during the peer-review process. Some differences between the published version and this version may remain and you are advised to consult the published version if you wish to cite from it.**

## **Residential and Nursing Homes: how can they meet the challenge of an aging population?**

**Szczepura A.** Residential and nursing homes: how can they meet the challenge of an aging population? *Future Medicine - Aging Health*. 2011; 7(6): 877-887.

**Contact:**

Ala Szczepura  
Professor of Health Technology Assessment,  
Coventry University,  
Coventry CV4 7AL,  
UK

Email: [ala.szczepura@coventry.ac.uk](mailto:ala.szczepura@coventry.ac.uk)

## **Summary:**

A rapidly aging population will challenge western health and social care services. Changing family structures are reducing the informal family carer's role. Rising incidence of dementia is increasing pressure on remaining carers. Demand for long-term residential care (LTC) places is rising and care homes are faced with increasingly older people with progressively more complex clinical and social needs. Systems are not prepared for the nature and volume of care associated with this demographic shift. Innovative ways of working will be required in LTC to maintain quality of care and contain costs. Technology to support new ways of working will be essential. Issues related to managing quality and outcomes, the interface with other organizations such as hospitals, and better professional integration will be needed. While technology is being developed rapidly for many aspects of life, its potential use in LTC to promote safe, high quality care for older people is significantly under-developed.

## **Keywords:**

Older people; Nursing homes; Long-term residential care; Quality improvement; Hospital admissions; Geriatric nursing; Professional; Medication; Telecare; Telecommunication in medicine

## **Abbreviations:**

ICT Information and communication technology

LTC Long-term residential care

QI Quality improvement

QoL Quality of life

RN Registered nurse

UK United Kingdom

US United States

## **An ageing population**

Life expectancy is increasing throughout the world. In the western world, a combination of falling mortality rates along with decreased fertility is producing an ageing population. The fastest growing segment in the population are people aged >75 years. In the United Kingdom (UK), the number of people aged over 75 years is projected to nearly double by 2033 and the number of advanced age (85 and over) is expected to increase by two-thirds in the next twenty years [1, 2]. An increasing number of people born in the 20<sup>th</sup> century can now expect to live to see their 100th birthday, with British 20-year-olds now twice as likely to reach this age as their parents and 500,000 centenarians predicted in the UK by 2066.

A rapidly aging population will transform society. As the number of elderly people grows, so will the pressure on social care and healthcare services. For example, in 2002 there were 900,000 older people in the UK with a high level of physical need, unable to carry out one or more activities of daily living; over the coming two decades numbers are predicted to increase by over 50%, with a proportionate increase in the ‘long-term care burden’ [3]

Historically, a significant proportion of long-term care for older people has been provided on an informal basis by family and friends. However, as family structures change and generations increasingly live apart, a growing number of older people find themselves living alone. Already in Europe one out of every three older adults not in institutional care lives alone [4]. This trend, combined with increased length of life, will inevitably lead to greater pressures on long-term residential care (LTC). In the UK, the majority of people currently living in LTC are aged over 85, and many suffer from cognitive impairment. It is estimated that 37% of people with dementia now live in a care home and this proportion rises with age to 61% of people with dementia aged over 90 [101]. With increases in the number of ‘frail elderly’, combined with rising dementia cases, the issue of how best to provide care in a cost-effective manner will be of increased importance in all countries [1, 5, 6]. Cost-effectiveness considers the balance between resource use or costs and outcomes achieved, such as quality of care [7].

## **Nursing & residential care homes**

In healthcare, changing patterns of delivery have resulted in fewer hospital beds, reduced lengths of stay and increased reliance on community health services; this pattern, observed in the UK, is mirrored in many countries [8]. The number of National Health Service (NHS) hospital beds for older people has fallen dramatically in recent decades and, as a result, the LTC sector has become an increasingly important provider of care for older people. In 2009 there were a total of 18,440 care homes for adults in England (mainly residential homes) providing beds for more than 457,500 people, compared to a total of 167,000 beds in hospitals [9][102, 103]. In the UK, the LTC sector contains two types of care home - residential or ‘care-only’ homes with no in-house nursing staff and nursing homes. The number of places in care-only homes fell slightly to 260,162 between 2004 and mid-2009 while nursing home places rose to 197,375, resulting in an overall increase in LTC places

[9]. This pattern reflects both a growing demand for long-term residential care and an increased need for clinical skills within this sector.

LTC inevitably consumes considerable government funds and this is predicted to increase in the future. In the UK, costs are rising even though only low-income people with limited assets currently receive public funding. Similarly, in the United States (US) although Medicare does not pay for most long-term care services and access to Medicaid is restricted to low-income individuals, costs are still rising [6]. In England, the total value of the long-term residential market is estimated at £22 billion, comprising approximately £16 billion of state funding and £6 billion of self-funded care [104]. Spending on care home placements has risen more rapidly than on support services provided in older people's own homes, and is predicted to continue to do so [1].

Meeting future clinical, personal and social care needs of an increasingly elderly population will be a major undertaking. A particular challenge in the UK is the fact that nearly six out of ten older people in LTC are cared for in a residential, or 'care-only', home with no on-site nurses. Although care-only homes offer economies of scale in terms of meeting social care needs, nursing input is constrained because of the reliance on external community nurses to meet residents' needs [10, 11]. Furthermore, needs and dependency levels may overlap in these two settings, with higher dependency residents observed in care-only homes and lower dependency older people in nursing homes [12].

## **Improving care for residents**

Although changes in the organization and delivery of care in the LTC sector will inevitably be required, even just to 'stand still', to date the evidence base for innovation remains limited. Indeed, a recent review of the literature has identified that research in the area of innovation in care homes is currently lacking, especially for residential or care-only homes [102]. The challenges of future LTC provision are not unique to the UK. Policy makers and providers in many countries have long been aware of the importance of facing up to this issue. The US Institute of Medicine produced a formative report in 2001 which advocated strengthening the care giving workforce, measurement and monitoring of quality of care, and improving care through the building of organizational capacity [13]. Little emphasis was placed on the future role of technology. However, in order to successfully address the twin challenges of sustaining quality of care and containing costs against rising demand, it is now clear that serious thought will need to be given the potential for use of new technology as well as workforce and organizational issues.

## **Quality improvement**

There is an extensive literature, mainly from the US, on quality and outcomes in care homes, but limited consensus on how best to manage quality in LTC. Early research has demonstrated that simply providing nursing homes with comparative quality performance information and education about quality improvement

does not improve care or resident outcomes [14]. Management style and organizational culture are both recognized to have an important impact on the success of any attempt to manage quality and improve outcomes in care homes. In the US, nursing home staff have reported that communication and leadership are essential to facilitate quality improvement [15]. In Australia, researchers found that, if success is to be achieved in improving practice and care standards, there is a need for management to be more transparent and to fully support the change process; conversely, factors found to inhibit the change process included unfavorable organizational culture and tokenistic support by management [16]. A study of resident outcomes in 200 Australian nursing homes similarly identified that the role of the senior nurse or manager is pivotal [17]. Other research has reported that quality improvement (QI) implementation is most likely to be successful in nursing homes with an underlying culture that promotes innovation [18]. Empowerment of staff is crucial. Interestingly, access to opportunity appears to be the most empowering factor for nurses in nursing homes and access to resources the least [19]. A further Australian study has shown that the impact of a policy change on nursing practice in LTC is dependent on management leadership [20]. In the US, a four year longitudinal study similarly concluded that embedding nursing best-care practice protocols in nursing homes requires a ‘change agent’ with sufficient formal or informal influence in addition to regulatory support and staff resources to implement and monitor practices [21]. A link between positive management practices and resident outcomes has also been demonstrated in 164 Texas nursing homes [22]. Positive practices such as communication openness and leadership were found to correlate with resident outcomes after allowing for differences in case-mix, size and ownership.

Even if a care home introduces quality improvement successfully, the size of any effect may not be large. Research in a cross-section of 65 Dutch nursing homes found that although quality improvement had a statistically significant influence on the number of undesirable outcomes, the actual effect size was small [23]. This raises the important question, rarely addressed, of whether quality improvement initiatives are cost-effective, since they can be expensive in terms of staff time required [24]. In Europe, monitoring quality in LTC has gained increasing attention in recent years with the development of international quality indicators for use in LTC to ensure ‘equivalence and sustainability’ [25] [105]. These cover aspects such as residents’ quality of life, organizational economic performance and leadership, as well as quality of care provision. However, translating these indicators into actual quality improvements at a reasonable cost for LTC organizations inevitably remains a challenge.

Interestingly, there may be indirect financial benefits to long-term care organizations from a focus on quality in terms of attracting high caliber staff and increasing the proportion of self-funding residents. Comparison of a sample of 125 Canadian nursing homes has shown that ‘magnet’ (employer-of-choice) status nursing homes are more likely to value quality improvement, have a progressive participatory decision-making culture, and spend a considerable amount on job-related training for their nursing staff [26]. Analysis of data from 17,000 US nursing homes also indicates that nursing homes can increase their private-pay residents by increasing quality, measured in terms such as psychotropic medication, catheterization, physical restraint and pressure ulcer rates [27].

An underlying issue, which will potentially limit the value of any future effort invested in quality and outcomes improvement seems to be a lack of sustainability for many initiatives. For example, in a longitudinal study of QI implementation in US not-for-profit nursing homes, based on the principles of staff empowerment, enhanced training, financial incentives (linked to reductions in pressure ulcer rates) and real-time feed-back, significant improvements were found initially [28]. However, this effect was not sustainable and was lost entirely during the post-intervention period. Similar issues are raised by UK research [29].

## Organizational interfaces

The organizational interface between care homes and hospitals is important both in economic terms and also in terms of older people's quality of life (QoL). Ways of optimizing this relationship can be challenging, especially in the 'twilight zone' of care-only homes [30]. A number of authors have highlighted the need to prevent unnecessary transfers from care homes because of the way in which hospitalization affects longer term outcomes for residents [31, 32]. Admission to hospital is reported to lead to a rapid decline in functioning and QoL for older people [33]. Other authors have reported large variations in hospital admission rates between care homes and identified the potential to reduce the number of hospitalizations in order to produce cost savings [34] [102]. However, the organizational characteristics influencing admission rates are unclear. Although multivariate analysis of published data shows that hospital admissions from care homes are linked to certain patient factors, such as prior hospitalizations, these cannot fully explain the differences observed and the influence of other organizational factors is less well understood [35].

Even so, various organizational interventions, such as improved clinical pathways, have been suggested for reducing readmissions and unplanned hospitalization rates [36]. In the UK, an algorithm to predict individuals at highest risk of readmission to hospital in the next 12 months has been developed, although the impact of intervening using this algorithm to reduce hospital admissions has still to be reported [37]. Other studies in the US, Australia and UK have identified the interface with hospital emergency care as particularly important when attempting to reduce unplanned hospitalizations [38, 39]. Within care homes, improved staff skill-mix and enhanced training appear to be important factors in preventing unnecessary hospital admissions. In a US study, hospitalizations were reduced through the employment of nurse practitioners or physician assistants in nursing homes, combined with the introduction of a certified nurse assistant training program [40]. The authors argue that this model may represent a cost-saving policy, although financial data are not presented. Economic modeling of an intensive organizational intervention aimed at reducing emergency re-admissions to hospital for older patients discharged home predicts cost savings and improved health outcomes for a program of comprehensive nursing and physiotherapy assessment, individually tailored exercise strategies, and nurse home visits with telephone follow-up for 24 weeks following discharge [41]. In the UK, a two year prospective evaluation of a dedicated in-reach nursing team providing enhanced support and training for residential care home staff was found to prevent unplanned hospital admissions and produce a net cost-saving [29].

Prevention of delayed discharge from hospital is also important in terms of containing costs and maximizing

QoL. Once hospitalized, health status and capability can deteriorate in a matter of days for older people, emphasizing the importance of timely hospital discharge [33]. In the US attempts to improve hospital-to-nursing home transfers are reported to have failed [42]. In England, it has been estimated that up to one-quarter of older people being discharged from hospital need intermediate or higher levels of care after the acute episode [43]. Post-discharge care therefore needs to be well organized to support earlier discharge. In Australia, a randomized controlled trial which evaluated the use of an off-site transitional care facility for elderly people in hospital moving to a LTC facility for the first time, showed that this could successfully ‘unblock’ hospital beds without any apparent adverse effects on patients [44]. In contrast, a Dutch study which evaluated a low intensity early discharge model of intermediate care between a university hospital and a residential home found that relatively unqualified staff and cultural differences between collaborating partners impeded implementation and limited the effectiveness of the model [45]. The authors conclude with commendable honesty that setting up the model was “less straightforward than was originally perceived by management”. A UK prospective study similarly found that early discharge from hospital to residential homes was more difficult to achieve than prevention of hospital admission, even with the support of an in-reach team and enhanced training of non-nursing care staff [29].

## Care home workforce

For long-term care of older people, the largest resource expenditure is on staff either directly employed in LTC or providing support services. In the UK, the care home sector is a major employer in the UK. There were an estimated 1.46 million people in directly employed roles in adult social care in England in 2009 [106]. These figures are comparable to the total of 1.21 million people reported to be working in the whole National Health Service (NHS) [107]. By 2025, the number of people working in adult social care is predicted to increase by up to 65%, with a probable total of 2.6 million staff predicted [106]. Currently, 629,000 people work in care homes, and of these 230,000 are care staff employed in care-only homes [108]. Furthermore, there are an estimated 37,000 GPs and just over 1,200 consultant geriatricians, many of whom are delivering healthcare to care homes across the UK [104]. In addition there are other specialists such as palliative care physicians and consultants in rehabilitation medicine whose skills are highly relevant to many care home residents. Better partnership working between all these professionals will be an important means of maintaining quality of care in LTC settings, as well as potentially reducing costs [6]. Approaches may need to differ depending on the institutional context, for example nursing home versus care-only home, or the professional input being considered e.g. nursing or medical.

### *Providing nursing input for residential homes*

Care-only homes with no on-site nursing staff are entirely reliant on support from external community nurses [46]. However, a review of the literature has identified that partnership working appears to predominantly occur by default and usually lacks any long-term strategy [47]. Workload and other pressures may limit the availability of these professionals to engage in effective partnership working. In the UK, this is linked to anxiety among community nurses that demand from care homes will be difficult to meet, reducing the



willingness of community nurses to develop strategic joint working. Such changes may also require initiation by, and support from, more senior management [29]. Once established, models of partnership working which involve initiatives such as dedicated, specialist community in-reach teams appear to be effective. When combined with basic clinical skills training for residential home staff, they also appear to be cost-effective [109]. In London, establishment of a multidisciplinary ‘care homes support team’, including an older people’s specialist nurse, is reported to have produced general benefits especially in managing the interface between LTC and primary care [48]. Another UK study which evaluated a dedicated in-reach nursing and physiotherapy team for care-only homes recorded an annual financial saving of over £330,000 after taking account of the cost of the specialist in-reach service [29]. Qualitative research examining the impact of a specialist care homes support team has concluded that it empowers care home staff, promotes more rapid access to services for residents, changes organizational culture, and supports management of long-term conditions [49].

### ***Enhanced clinical care in nursing homes***

In many countries there are no care-only homes and long-term residential care is provided entirely by nursing homes. In such homes, much of the routine clinical care required by older people can be met by in-house nurses. But residents will still require input from other health professionals, such as specialist nurses. The benefit of introducing higher-functioning, specialist nurse practitioners into nursing homes has been reported in a series of studies from the US starting in the late 80’s. Geriatric nurse practitioners (GNPs) working with staff in nursing homes have been successful in improving outcomes through the introduction of care protocols for specific clinical problems e.g. pressure ulcers, incontinence, depression or aggressive behavior [50]. Analysis of work patterns indicates that GNPs provide a wide range of services including urgent resident visits, preventive care, hospice care and wound care [51]. Furthermore, organization-level strategic intervention by these nurse practitioners, on top of provision of direct care and staff training, can produce significant added benefits [52]. Another approach, case management of frail elderly nursing home residents (EverCare model), has been reported to reduce mortality and preventable hospitalizations in the US, but not to have any impact on other outcomes or quality indicators [53]. Transfer of the EverCare model to the UK initially led to some enthusiastic reports [54]. But the final evaluation found no significant effect on the rates of emergency hospital admissions, emergency bed days or mortality [110]. In Australia, studies triggered by an emerging crisis in attracting and retaining skilled registered nurses (RNs) in nursing homes, have identified a need to empower RNs in order for collaboration between professionals to succeed [55]. In Norway, researchers report that nurses in nursing homes and district nurses can successfully use negotiation and awareness raising to empower themselves and their residents [56]. More recently, it has been identified that organization of the internal nursing home workforce into teams can further enhance care and be a cost-saving strategy [57].

### ***Medical input for care homes***

The organization of medical care provision for long-term residential care appears to require improvement in many countries [102]. In the US, it has long been accepted that the organization of physician input is an important factor influencing quality of care and patient outcomes [58]. Even so, relatively few studies have attempted to measure the relationship between medical input and resident outcomes. More recently the questions of whether physicians’ input might be enhanced by encouraging specialization in nursing home care,

and whether quality of care could be improved by paying physicians on quality-of-care measures, have both been raised, but evidence of effectiveness is lacking [59]. Early research in the UK similarly concluded that if medical care can be restructured to give greater scope for proactive and preventive interventions, this would improve outcomes for residents [60]. The Netherlands is the only country in Europe to have introduced a new specialty of ‘nursing home medicine’. Initial assessment has identified that improved communication through personal contact between the new ‘nursing home physicians’ and existing GPs is essential in order to ensure exchange of relevant information [61]. Training of social care staff in residential homes also appears to result in more effective communication with GPs and the prevention of unnecessary hospital admissions [29]. A recent trial of ‘shared management’ between community geriatricians and GPs in the UK, where GPs were offered access to comprehensive geriatric assessments, rapid feedback and a telephone advisory service for patients in residential homes, appears to have been highly successful [62]. After six months, hospital admissions were more than halved and requests for visits fell by 37%, but any overall cost saving was not estimated. Inclusion of specialist medical input will, of course, have cost consequences and depend on availability. In England, currently only 1% of total consultant geriatrician time is allocated to care home work and less than one in five Primary Care Trusts report that they fund geriatricians’ involvement in care homes [104]. Collaboration between specialist geriatric nurse practitioners and physicians also appears to enhance the care provided to nursing home residents [63].

## **Role of new technology**

With the predicted rapid growth in the elderly population, scientists have been exploring new ways for technology to support independent living and maintain quality of life. Use of information and communication technologies (ICTs) in LTC can improve care of older people by enabling more effective and efficient use of medical and nursing professionals’ time and better use of scarce hospital beds. The potential for ‘telecare’ or ‘telemedicine’ to support older people in various settings has been widely discussed in the literature, especially in terms of chronic disease management [64, 65]. The European Commission has recently funded an international project to evaluate the impact of telecare systems in LTC settings and older people’s own homes in terms of reducing the burden on formal and informal carers, improving safety, and generating cost savings [111]. However, various organizational and structural barriers may need to be addressed before such technologies can move into mainstream service use [66]. These include tackling the lack of financial incentives for care homes to introduce new technology, addressing medico-legal and regulatory concerns, identifying the organizational changes that will be needed to accommodate telecare delivery and, once introduced, managing conflicting demands on professionals’ time.

### ***Remote clinical monitoring & access to expertise***

Several ICTs are currently under development for maintenance of health in older people. These range from disease monitoring services to ‘lifestyle monitoring’ which can detect changes in behavior patterns. To date, most effort has concentrated on the application of technology to enable older people to remain in their own homes with the support of informal family carers. However, remote patient monitoring is now being introduced

into care home settings. Introduction in the UK has highlighted the need for staff training to support required changes in professionals' working practices and styles of interpersonal communication. For example, staff in LTC settings may need to learn how to seek support when reporting a problem and healthcare staff how to respond appropriately [67]. Older people's reactions to the introduction of telecare also identify a need to consider privacy, human interaction and sustainability as well as usability [68].

A recent 'review of systematic reviews' provides good evidence that use of real-time (synchronous) telecare can be successfully introduced and improve health outcomes through enhanced disease monitoring and better communication with health care professionals [69]. For specific conditions such as congestive heart failure, the use of home-based telecare as part of a multidisciplinary interventional program has also been demonstrated to reduce mortality [70]. The evidence also shows that integration into existing health care systems can produce economic benefits for people with chronic conditions living at home or for elderly patients recently discharged from hospital [71]. Building on this evidence, real-time telecare may offer a cost-effective means of providing support for older people discharged to LTC. There is also evidence from this review that in specialties dependent on therapeutic communication (e.g. psychiatry), real-time telecare can produce health outcomes that are equivalent to those obtained through traditional person-to-person interaction. However, research examining the potential for telecare to replace community nurse visits to patients' own homes found that only 15% of contacts could be replaced by real-time telecare; the remainder involved 'hands-on' interventions which could not be delivered without the nurse being present [72]. In contrast, in a LTC setting it should be possible to replace a much larger proportion of nurse visits with care home staff delivering interventions under tele-supervision after training.

To date, technology adoption remains very low. In 2008, telemedicine accounted for only 0.9% of the total European eHealth market [112]. This may partly be explained by the fact that development has to date been technology-led, rather than tailored to more frequent or specific high risk situations for older people and their carers [73].

### ***Remote medication management systems***

Medication management systems provide an example of a technology application which has been developed specifically to address the common risk of medication errors in LTC. Older people are at increased risk of medication-related errors due to a combination of factors including polypharmacy and age-related changes in the body's response to medicines. Errors can be due to mistakes made by physicians when prescribing, dispensing errors made by pharmacies or administration errors made by care home staff. These can lead to a large number of adverse events, especially avoidable hospital admissions [74]. Prescribing and dispensing errors in LTC occur off-site and can be addressed by interventions such as use of extended nurse prescribing [75] or provision of an enhanced pharmacy service to care homes [76]. On-site errors associated with administration of prescribed medication are more difficult to address. These appear to be largely linked to organizational factors, with interruptions to medicine rounds identified as the most common [77]. Studies show that there are on average 5 interruptions to each medication round in long-term care facilities [78]. In situations where nurses or senior care staff are regularly interrupted, the risk of these distractions leading to

failure to adhere to a person's medication plan is recognized to be high [79]. Implementation of a pharmacy-led, remote medication management system which produces real-time alerts to potential errors has been shown to produce virtually complete conformity with medication administration plans and negligible system work-around by staff [80].

## Future perspective

A rapidly aging population will inevitably increase pressures on long-term residential care. As people live longer and changing family structures reduce the number of informal carers, the care home sector will need to identify how best to provide cost-effective 'bundles of care' to meet increasingly complex clinical and social care needs of older residents. Cost-effective care will need to ensure that outcomes, such as quality of care, are maintained while resource use and costs are contained. Meeting this twin challenge will require change and innovation based on a sound evidence base. Particularly challenging will be settings with no in-house nursing staff, such as UK 'care-only' homes.

For any care service, the largest expenditure is on staff. Better partnership working between nursing, social care and medical professionals will be essential for future care provision to meet long-term residential care needs. The interface between care homes and other organizations will need to be better managed to prevent unnecessary hospitalizations which can affect costs and longer term health of residents. Improved care home staff skill-mix and enhanced training appear to be important factors in achieving this. Linked to this, a consensus on how best to manage quality and maximize health outcomes in care homes is required. Positive management practices such as communication openness and leadership style appear to have an important impact on the success of any such initiatives and the role of the senior managers is pivotal.

In long-term residential care, with many small units spread over a large area and often distanced from hospitals and GPs, there seem to be opportunities for collaboration and leadership in the development of high quality evidence to guide decisions about new ways of working and quality improvement. Telecare is currently underutilized but may offer a cost-effective solution in many contexts. With the rapid development of free Internet-based videoconferencing tools and inexpensive consumer based devices, such as video-enabled mobile phones, real-time telecare should become a method of mainstream healthcare delivery for care homes. However, a lack of evidence to guide implementation may lead to underuse, or inappropriate use, of this potentially valuable technology. Research is urgently needed to guide investment of scarce resources in telecare programs in LTC settings.

## References:

1. Wanless D: **Securing good care for older people: taking a long-term view**. Edited by London: King's Fund; 2006.
2. Office for National Statistics: **Statistical Bulletin. National population projections, 2008 based**. Office for National Statistics; 2009.
3. Personal Social Services Research Unit: **Wanless Review of Social Care. Wanless Social Care Review Research Report**. London: PSSRU, London School of Economics; 2006.
4. Cannuscio C, Block J, Kawachi I: **Social capital and successful aging: the role of senior housing**. *Ann Intern Med* 2003, **139**(5 Pt 2):395-399.
5. Deeming C, Keen J: **Paying for old age?** London: King's Fund; 2000.
6. Ahlstrom A, Clements E, Tumlinson A, Lambrew J: **The Long-Term Care Partnership Program. Issues and options**. Washington: The Brookings Institution; 2004.
7. Szczepura AK KJ (Ed.): *Assessment of Health Care Technologies: Case Studies, Key Concepts and Strategic Issues*.: John Wiley, Chichester, UK.; 1996.
8. Department of Health: **The NHS Plan: A plan for investment. A plan for reform**. London: Department of Health; 2000.
9. Care Quality Commission: **The state of health care and adult socialcare in England An overview of key themes in 2009/10** London: CQC; 2011.
10. Carpenter I, Perry M, Challis D, Hope K: **Identification of registered nursing care of residents in English nursing homes using the Minimum Data Set Resident Assessment Instrument (MDS/RAI) and Resource Utilisation Groups version III (RUG-III)**. *Age Ageing* 2003, **32**(3):279-285.
11. Challis D, Mozley CG, Sutcliffe C, Bagley H, Price L, Burns A, Huxley P, Cordingley L: **Dependency in older people recently admitted to care homes**. *Age Ageing* 2000, **29**(3):255-260.
12. Rothera I, Jones R, Harwood R, Avery A, Waite J: **Health status and assessed need for a cohort of older people admitted to nursing and residential homes**. *Age Ageing* 2003, **32**(3):303-309.
13. Institute of Medicine: *Improving the quality of long-term care*.: Washington: National Academy Press; 2001.
14. Rantz MJ, Popejoy L, Petroski GF, Madsen RW, Mehr DR, Zwygart-Stauffacher M, Hicks LL, Grando V, Wipke-Tevis DD, Bostick J *et al*: **Randomized clinical trial of a quality improvement intervention in nursing homes**. *Gerontologist* 2001, **41**(4):525-538.
15. Scott-Cawiezell J, Schenkman M, Moore L, Vojir C, Connolly RP, Pratt M, Palmer L: **Exploring nursing home staff's perceptions of communication and leadership to facilitate quality improvement**. *J Nurs Care Qual* 2004, **19**(3):242-252.
16. Chenoweth L, Kilstoff K: **Organizational and structural reform in aged care organizations: empowerment towards a change process**. *J Nurs Manag* 2002, **10**(4):235-244.
17. Pearson A, Hocking S, Mott S, Riggs A: **Management and leadership in Australian nursing homes**. *Nurs Pract* 1992, **5**(2):24-28.
18. Berlowitz DR, Young GJ, Hickey EC, Saliba D, Mittman BS, Czarnowski E, Simon B, Anderson JJ, Ash AS, Rubenstein LV *et al*: **Quality improvement implementation in the nursing home**. *Health Serv Res* 2003, **38**(1 Pt 1):65-83.
19. DeCicco J, Laschinger H, Kerr M: **Perceptions of empowerment and respect: effect on nurses' organizational commitment in nursing homes**. *J Gerontol Nurs* 2006, **32**(5):49-56.
20. Jeong SY, Keatinge D: **Innovative leadership and management in a nursing home**. *J Nurs Manag* 2004, **12**(6):445-451.
21. Beck C, Heacock P, Mercer SO, Doan R, O'Sullivan PS, Stevenson JG, Schnelle JF, Hoskins JG: **Sustaining a best-care practice in a nursing home**. *J Healthc Qual* 2005, **27**(4):5-16.
22. Anderson RA, Issel LM, McDaniel Jr RR: **Nursing homes as complex adaptive systems: relationship between management practice and resident outcomes**. *Nurs Res* 2003, **52**(1):12-21.
23. Wagner C, Klein Ikkink K, van der Wal G, Spreeuwenberg P, de Bakker DH, Groenewegen PP: **Quality management systems and clinical outcomes in Dutch nursing homes**. *Health Policy* 2006, **75**(2):230-240.
24. Rosen J, Mittal V, Degenholtz H, Castle N, Mulsant BH, Hurland S, Nace D, Rubin F: **Ability, incentives, and management feedback: organizational change to reduce pressure ulcers in a nursing home**. *J Am Med Dir Assoc* 2006, **7**(3):141-146.
25. **Measuring Progress: Indicators for Care Homes**.  
[\[http://www.euro.centre.org/data/progress/PROGRESS\\_ENGLISH.pdf\]](http://www.euro.centre.org/data/progress/PROGRESS_ENGLISH.pdf)
26. Rondeau KV, Wagar TH: **Nurse and resident satisfaction in magnet long-term care organizations: do high involvement approaches matter?** *J Nurs Manag* 2006, **14**(3):244-250.
27. Castle NG: **Does quality pay for nursing homes?** *J Health Soc Policy* 2005, **21**(2):35-51.

28. Rosen J, Mittal V, Degenholtz H, Castle N, Mulsant B, Rhee YJ, Hulland S, Nace D, Rubin F: **Organizational change and quality improvement in nursing homes: approaching success.** *J Healthc Qual* 2005, **27**(6):6-14, 21, 44.
29. Szczepura A, Nelson S, Wild D: **In-reach specialist nursing teams for residential care homes: uptake of services, impact on care provision and cost-effectiveness.** *BMC Health Serv Res* 2008, **8**:269.
30. Jacobs S, Glendinning C: **The twilight zone: NHS services for older people in residential and nursing homes.** *Quality in Ageing - Policy, practice and research* 2001, **2**(2):3-112.
31. Boockvar KS, Gruber-Baldini AL, Burton L, Zimmerman S, May C, Magaziner J: **Outcomes of infection in nursing home residents with and without early hospital transfer.** *J Am Geriatr Soc* 2005, **53**(4):590-596.
32. Kruse RL, Mehr DR, Boles KE, Lave JR, Binder EF, Madsen R, D'Agostino RB: **Does hospitalization impact survival after lower respiratory infection in nursing home residents?** *Med Care* 2004, **42**(9):860-870.
33. Graf C: **Functional decline in hospitalized older adults.** *Am J Nurs* 2006, **106**(1):58-67, quiz 67-58.
34. Cheng HY, Tonorezos E, Zorowitz R, Novotny J, Dubin S, Maurer MS: **Inpatient care for nursing home patients: an opportunity to improve transitional care.** *J Am Med Dir Assoc* 2006, **7**(6):383-387.
35. Miller EA, Weissert WG: **Predicting elderly people's risk for nursing home placement, hospitalization, functional impairment, and mortality: a synthesis.** *Med Care Res Rev* 2000, **57**(3):259-297.
36. Loeb M, Carusone SC, Goeree R, Walter SD, Brazil K, Krueger P, Simor A, Moss L, Marrie T: **Effect of a clinical pathway to reduce hospitalizations in nursing home residents with pneumonia: a randomized controlled trial.** *JAMA* 2006, **295**(21):2503-2510.
37. Billings J, Dixon J, Mijanovich T, Wennberg D: **Case finding for patients at risk of readmission to hospital: development of algorithm to identify high risk patients.** *BMJ* 2006, **333**(7563):327.
38. Roland M, Dusheiko M, Gravelle H, Parker S: **Follow up of people aged 65 and over with a history of emergency admissions: analysis of routine admission data.** *BMJ* 2005, **330**(7486):289-292.
39. Finn JC, Flicker L, Mackenzie E, Jacobs IG, Fatovich DM, Drummond S, Harris M, Holman DC, Sprivulis P: **Interface between residential aged care facilities and a teaching hospital emergency department in Western Australia.** *Med J Aust* 2006, **184**(9):432-435.
40. Intrator O, Zinn J, Mor V: **Nursing home characteristics and potentially preventable hospitalizations of long-stay residents.** *J Am Geriatr Soc* 2004, **52**(10):1730-1736.
41. Graves N, Courtney M, Edwards H, Chang A, Parker A, Finlayson K: **Cost-effectiveness of an intervention to reduce emergency re-admissions to hospital among older patients.** *PLoS One* 2009, **4**(10):e7455.
42. Boockvar KS, Burack OR: **Organizational relationships between nursing homes and hospitals and quality of care during hospital-nursing home patient transfers.** *J Am Geriatr Soc* 2007, **55**(7):1078-1084.
43. Young J, Forster A, Green J: **An estimate of post-acute intermediate care need in an elderly care department for older people.** *Health Soc Care Community* 2003, **11**(3):229-231.
44. Crotty M, Whitehead CH, Wundke R, Giles LC, Ben-Tovim D, Phillips PA: **Transitional care facility for elderly people in hospital awaiting a long term care bed: randomised controlled trial.** *BMJ* 2005, **331**(7525):1110.
45. Ploch T, Delnoij DM, van der Kruk TF, Janmaat TA, Klazinga NS: **Intermediate care: for better or worse? Process evaluation of an intermediate care model between a university hospital and a residential home.** *BMC Health Serv Res* 2005, **5**:38.
46. Goodman C, Robb N, Drennan V, Woolley R: **Partnership working by default: district nurses and care home staff providing care for older people.** *Health Soc Care Community* 2005, **13**(6):553-562.
47. Goodman C, Woolley R: **Older people in care homes and the primary care nursing contribution: a review of relevant research.** *Primary Health Care Research & Development*, 2004, **5**(3):211-218.
48. Hayes N, Martin F: **Supporting care homes: the older people's specialist nurse.** *Br J Nurs* 2004, **13**(21):1250-1257.
49. Doherty D, Davies S, Woodcock L: **Examining the impact of a specialist care homes support team.** *Nurs Stand* 2008, **23**(5):35-41.
50. Krichbaum KE, Pearson V, Hanscom J: **Better care in nursing homes: advanced practice nurses' strategies for improving staff use of protocols.** *Clin Nurse Spec* 2000, **14**(1):40-46.
51. Rosenfeld P, Kobayashi M, Barber P, Mezey M: **Utilization of nurse practitioners in long-term care: findings and implications of a national survey.** *J Am Med Dir Assoc* 2004, **5**(1):9-15.
52. Krichbaum K, Pearson V, Savik K, Mueller C: **Improving resident outcomes with GAPN organization level interventions.** *West J Nurs Res* 2005, **27**(3):322-337.
53. Kane RL, Flood S, Bershadsky B, Keckhafer G: **Effect of an innovative medicare managed care program on the quality of care for nursing home residents.** *Gerontologist* 2004, **44**(1):95-103.
54. Jehan W, Nelson C: **Advanced primary nursing: liberating the talents.** *Nurs Manag (Harrow)* 2006, **12**(9):20-23.
55. Cheek J, Ballantyne A, Jones J, Roder-Allen G, Kitto S: **Ensuring excellence: an investigation of the issues**

- that impact on the registered nurse providing residential care to older Australians.** *Int J Nurs Pract* 2003, **9**(2):103-111.
56. Slettebo A: **Empowerment in nursing homes: lessons for district nursing?** *Br J Community Nurs* 2006, **11**(3):115-118.
  57. Mukamel DB, Cai S, Temkin-Greener H: **Cost implications of organizing nursing home workforce in teams.** *Health Serv Res* 2009, **44**(4):1309-1325.
  58. Karuza J, Katz PR: **Physician staffing patterns correlates of nursing home care: an initial inquiry and consideration of policy implications.** *J Am Geriatr Soc* 1994, **42**(7):787-793.
  59. Levy CR, Kramer AM: **Physician practice patterns in nursing homes.** *Long-term Care Interface* 2005, **6**(12):17-23.
  60. Pell J, Williams S: **Do nursing home residents make greater demands on GPs? A prospective comparative study.** *Br J Gen Pract* 1999, **49**(444):527-530.
  61. Schols JM, de Veer AJ: **Information exchange between general practitioner and nursing home physician in The Netherlands.** *J Am Med Dir Assoc* 2005, **6**(3):219-225.
  62. Briggs D, Bright L: **Reducing hospital admissions from care homes: considering the role of a local enhanced service from GPs.** *Working with Older People* 2011, **15**(1):4-12.
  63. Caprio TV: **Physician practice in the nursing home: collaboration with nurse practitioners and physician assistants.** *Annals of Long-Term Care* 2006, **14**(3):17-24.
  64. Audit Commission: **Older people. Implementing Telecare.** London: Audit Commission; 2004.
  65. Garcia-Lizana F, Sarria-Santamera A: **New technologies for chronic disease management and control: a systematic review.** *J Telemed Telecare* 2007, **13**(2):62-68.
  66. Barlow J, Bayer S, Castleton B, Curry R: **Meeting government objectives for telecare in moving from local implementation to mainstream services.** *J Telemed Telecare* 2005, **11** Suppl 1:49-51.
  67. Bratan T, Choudrie J, Clarke M, Jones R: **Human and organisational aspects of remote patient monitoring in residential care homes.** *Int J Electron Healthc* 2007, **3**(1):123-134.
  68. Courtney KL, Demiris G, Hensel BK: **Obtrusiveness of information-based assistive technologies as perceived by older adults in residential care facilities: a secondary analysis.** *Med Inform Internet Med* 2007, **32**(3):241-249.
  69. Deshpande A, Khoja S, McKibbin A, Jadad AR: **Real-Time (Synchronous) Telehealth in Primary Care: Systematic Review of Systematic Reviews [Technology report no 100].** Ottawa: Canadian Agency for Drugs and Technologies in Health; 2008.
  70. Holland R, Battersby J, Harvey I, Lenaghan E, Smith J, Hay L: **Systematic review of multidisciplinary interventions in heart failure.** *Heart* 2005, **91**(7):899-906.
  71. Tran K, Polisen J, Coyle D, Coyle K, Kluge E-H W, Cimon K, McGill S, Noorani H, Palmer K, R S: **Home telehealth for chronic disease management [Technology report no 113].** Ottawa: Canadian Agency for Drugs and Technologies in Health; 2008.
  72. Wootton R, Loane M, Mair F, Moutray M, Harrisson S, Sivananthan S, Allen A, Doolittle G, McLernan A: **The potential for telemedicine in home nursing.** *J Telemed Telecare* 1998, **4**(4):214-218.
  73. Papadopoulos H: **Tile-ippokratis: the experience of an ehealth platform for the provision of health care services in the island of chios and cyprus.** *Int J Telemed Appl* 2010, **2010**.
  74. Vinks TH, Egberts TC, de Lange TM, de Koning FH: **Pharmacist-based medication review reduces potential drug-related problems in the elderly: the SMOG controlled trial.** *Drugs Aging* 2009, **26**(2):123-133.
  75. Astles J: **Extended nurse prescribing: improving care for older people.** *Br J Nurs* 2006, **15**(3):150-151.
  76. Jones K: **Effective pain management: lessons from a nursing home research study.** *J Healthc Qual* 2006, **28**(1):41-47.
  77. Westbrook JI, Woods A, Rob MI, Dunsmuir WT, Day RO: **Association of interruptions with an increased risk and severity of medication administration errors.** *Arch Intern Med* 2010, **170**(8):683-690.
  78. Thomson MS, Gruneir A, Lee M, Baril J, Field TS, Gurwitz JH, Rochon PA: **Nursing time devoted to medication administration in long-term care: clinical, safety, and resource implications.** *J Am Geriatr Soc* 2009, **57**(2):266-272.
  79. Hamilton HJ, Gallagher PF, O'Mahony D: **Inappropriate prescribing and adverse drug events in older people.** *BMC Geriatr* 2009, **9**:5.
  80. Wild D, Nelson S, A. S: **Minimising medication errors.** *Care Management Matters* 2010, **November 2010**:40-43.

## WEBSITES

- Alzheimer's Society. Dementia UK: The full report. 2007 [cited 2011 4th July 2011]; Available from: <http://www.yhip.org.uk/silo/files/dementia-uk--the-full-report.pdf>.
- Szczepura A, Nelson S, Wild D. Improving care in residential care homes: a literature review. Joseph Rowntree Foundation 2008.: Joseph Rowntree Foundation York; 2008; Available from: <http://www.jrf.org.uk/knowledge/findings/socialcare/2326.asp>.
- Care Quality Commission. Social Care Provision in England. Data supplied by Regulated Social Care & Independent Healthcare Analytics Team. Intelligence Directorate, Care Quality Commission. (Registration.InspectionData@csci.gsi.gov.uk). CQC, London 2009.
- British Geriatrics Society Joint Working Party Inquiry. A Quest for Quality. An Inquiry into the Quality of Healthcare Support for Older People in Care Homes: A Call for Leadership, Partnership and Improvement.: British Geriatrics Society London; 2011 [cited 2011 22 July]; Available from: [http://www.bgs.org.uk/index.php?option=com\\_content&view=article&id=1487&Itemid=719](http://www.bgs.org.uk/index.php?option=com_content&view=article&id=1487&Itemid=719).
- European Centre for Social Welfare Policy and Research. Measuring Progress: Indicators for Care Homes. 2010 [cited 2011 4 July 2011]; Available from: [http://www.euro.centre.org/data/progress/PROGRESS\\_ENGLISH.pdf](http://www.euro.centre.org/data/progress/PROGRESS_ENGLISH.pdf).
- Skills for Care. The State of the Adult Social Care Workforce in England, 2010. . 2010 [20 July 2011]; Available from: [http://www.skillsforcare.org.uk/research/research\\_reports/state\\_of\\_the\\_adult\\_social\\_care\\_workforce\\_reports.aspx](http://www.skillsforcare.org.uk/research/research_reports/state_of_the_adult_social_care_workforce_reports.aspx).
- NHS - The Information Centre. Monthly NHS Hospital and Community Health Service (HCHS) Workforce Statistics in England - March 2011. . 2011 [cited 2011 20 July 2011]; Available from: <http://www.ic.nhs.uk/statistics-and-data-collections/workforce/nhs-staff-numbers/monthly-nhs-hospital-and-community-health-service-hchs-workforce-statistics-in-england--march-2011-provisional-experimental-statistics>.
- Skills for Care. The State of the Adult Social Care Workforce in England, 2008. . 2008 [20 July 2011]; Available from: [http://www.skillsforcare.org.uk/research/research\\_reports/state\\_of\\_the\\_adult\\_social\\_care\\_workforce\\_reports.aspx](http://www.skillsforcare.org.uk/research/research_reports/state_of_the_adult_social_care_workforce_reports.aspx).
- National Care Homes Research and Development (NCHR&D) Forum. My Home Life: Quality of life in care homes – A literature review. 2007; Available from: [http://myhomelifemovement.org/downloads/mhl\\_review.pdf](http://myhomelifemovement.org/downloads/mhl_review.pdf).
- Boaden R, Dusheiko M, Gravelle H, Parker S, Roland M, Sargent P, et al. Evercare Evaluation: Final Report. 2006 [cited 2011 20 July]; Available from: <http://www.medicine.manchester.ac.uk/primarycare/npcrdc-archive/Publications/NOV06%20EVERCARE%20FINAL%20REPORT.pdf>.
- Unobtrusive Smart Environments for Independent Living (USEFIL). EC Seventh Programme framework (ICT Call 7) - FP7-ICT-201 1-7.
- Valeri L, Giesen D, Jansen P, Klokgieters K. Business Models for eHealth, Final Report, Prepared for ICT for Health Unit DG Information Society and Media European Commission 28 February 2010 [cited 2011 20 July]; Available from: [http://ec.europa.eu/information\\_society/newsroom/cf/news.cfm?redirection=1&item\\_type=library&tpa\\_id=23](http://ec.europa.eu/information_society/newsroom/cf/news.cfm?redirection=1&item_type=library&tpa_id=23).