

Editorial

Current state and future possibilities for ambient intelligence to support improvements in the quality of health and social care

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Many of us working in health and social care might not immediately understand the term 'ambient intelligence' (AmI). The 'intelligence' referred to in AmI is the microprocessor which is able to glean knowledge from the 'ambient' environment of the individual and respond accordingly. The environment in this case encompasses the social, psychological or physical circumstances of the individual as well as their surroundings. AmI was a term coined at the turn of the last century by Eli Zelkha and Brian Epstein who organised a series of presentations on behalf of Phillips to envision how information communication and technology would evolve in the 21st century. Another definition of ambient, although now obsolete, is 'ambitious or aspiring' but this seems particularly apt with regard to AmI.¹ The application of AmI to health care has great potential for quality improvement² in terms of user experience,³ patient safety and effectiveness (efficiency), but to what extent is this vision realistic or illusory? This question is the subject of a new report by Schuurman and colleagues from the Netherlands.⁴

The concept of AmI provides a future vision for health and social care where information and communication technology have developed to a state where human–computer interactions are ubiquitous, pervasive and persuasive and where they are able to influence an individual's quality of life and health. It is a vision of computer technology which is subtly embedded in the individual or their surroundings ('integration'), which is able to recognise and monitor the person or their environment ('context awareness') and capable of responding to ('adaptation') or even anticipating ('anticipation') physical, psychological or social changes and needs in an individual way ('personalisation') by informing or prompting the individual or their networks of formal or informal care. Most present day examples of AmI described in the literature are still in their prototype phase.⁵

The AmI concept is a development of a perhaps more familiar concept in the UK, 'telecare', which has been defined as 'a service bringing health and social care directly to a user, generally in their own homes, supported by information and communication technology'.⁶ In the UK the Department of Health, by allocating £80 million for telecare to local authorities from April 2006 (through the Preventative Technology Grant), made it clear that the use of new technology was seen as a key element of the support system for people with long-term care needs.⁷ Similar developments are occurring in other countries. As miniaturisation and the processing power of computers advances,⁸ the application of technology to provide support for long-term health and preventive care is just starting to be realised, with increasingly novel systems just over the horizon.

Schuurman and colleagues take us through a series of case scenarios both in the present and the future, to describe the current use of technology in health care and the potential for AmI to develop this further.⁴ The case studies are realistic in their detail and complexity and represent or use real life scenarios relating to disease management, healthcare provision or preventive activities such as exercise. Although examples are based on what is happening now in the Netherlands the contemporary and future scenarios are very relevant to a broad variety of health service models and in this respect have meaning for an international audience.

The scenarios illustrate the application of ambient technology to the care of various situations including residential care for dementia, rehabilitation after a heart attack, treatment of cerebral palsy, long-term care of breast cancer and athletic performance. The case studies are presented and analysed in terms of which needs are not being met; they then focus on particular needs in each case to illustrate the potential benefits of ambient technology but also potential latent problems in its use.

In an idealised AmI future, a patient with dementia might be enabled to live at home for longer through monitoring, reminders, alarms and communication with carers and relatives. In the case of cancer, AmI could support case managers to co-ordinate better care, psychosocial support and feedback for patients than the current, often fragmented, system with poor communication between specialists, different options for and approaches to care and consequent uncertainty and anxiety for patients. Care for long-term conditions such as cerebral palsy could be better co-ordinated between family and specialists, with better communication and assessment of progress using AmI. For an athlete, AmI could provide shared information between the user and experts to enable consistent and co-ordinated advice that is appropriate to both immediate performance and health.

In each case the possible beneficial effects and advantages but also potential drawbacks of the technology need to be considered. For example, monitoring an individual's behaviour or physiology raises ethical issues of autonomy, non-maleficence and distributive justice. An individual might unknowingly disclose confidential information about their behaviour which they would rather not reveal because of its personal nature or because it has consequences which limit subsequent activities (such as travel) because insurance is withdrawn or made conditional. Regular use might lead to reliance on the technology, atrophy of a user's personal resources and a degree of dependence. Certain types of AmI may encourage activities or behaviours that inadvertently produce adverse effects on health, and this is particularly so when there are conflicting aims of health. Some health systems and insurers may fund ambient technology, whereas others will not. At a point in time AmI may be so pervasive and integral to health technologies that it will not be possible to choose whether to have it or not. These are crucial areas which are often not addressed in published evaluations of AmI.⁵ As AmI is introduced, research to understand these issues using ethnographic and other methods will be vital.⁹ Socio-political and cultural concerns remain, such as the potential for technology to increase rather than reduce social isolation; the danger of those trying to control data using or misusing them for their own ends; the conflicting needs of payers, regulators, commissioners, providers and users of health care; the effect on professional power; and the risks of intrusion and the problem of hyper-reality where the virtual becomes indistinguishable from the real to an individual.

As well as these ethical issues it is important to be clear about what such new technology can or cannot do: it can inform decisions but cannot always make them and nor would we wish it to do so, even with complex algorithms in place; it will not discuss issues or debate uncertainties; it cannot change an individual's

competence to undertake day-to-day tasks; the information it provides is only based on what it measures – and that might determine what is focused on to the exclusion of other important issues; some measures, such as pain or quality of life, will necessarily be based on the subjective experience of the user; the information provided needs to be interpreted correctly; adaptation needs to be sensitive to an individual's changing preferences as well as patterns of information.

Schuurman and colleagues also focus on the wider context of AmI in terms of the stakeholders and their claims for control of the technology, concordance or conflict with current healthcare policy and the future of health care. As far as control is concerned, the role of government and the effects of consumerism and market forces are emphasised, although with the complexity of health systems¹⁰ and the increasingly rapid developments in technology it is difficult to see how governments can control the evolution of AmI. Although future trends such as decentralisation, prevention and the enhancement of human potential are important there are limits; it is important to recognise that striving to increase these through AmI at the expense of other aspects of the health and social care system could have detrimental effects. Finally the future of ambient technology in a highly complex and networked health system is discussed and followed by an exposition of the benefits, problems and urgent issues for consideration.

The central message put forward by Schuurman and colleagues is that AmI offers great potential for health but that its drawbacks lie in aspects that are integral to the technology itself. There are a number of features of AmI that are important to consider in future implementation and evaluation. AmI is not a single health technology but an array of health technologies or adjuncts to health technologies with one or more common features. AmI is a complex intervention (i.e. involving more than one component) which critically involves interaction between the tool, the patient, the provider and the wider health system.¹¹ AmI will inevitably form part of a complex system, and will behave as such, providing difficulties in analysing and predicting its effects.¹⁰ Finally, AmI creates a range of problems for researchers in trying to design, evaluate and demonstrate effectiveness and cost-effectiveness of complex interventions which include it as a component.¹²⁻¹⁴

AmI is not only viable, its diffusion into future health and social care applications seems inevitable. The only question is what form this will take. Its dangers lie in the potential for policymakers, regulators, government and commissioners of health and social care to pretend that it will not happen, to misunderstand the health and ethical implications of introduction and to fail to evaluate its benefits and costs in the widest terms before widespread adoption.

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PEER REVIEW

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CONFLICTS OF INTEREST

None.

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