Response to Lords Select Committee on Artificial Intelligence: Artificial Intelligence to Improve the UK's Health and Social Care

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SCAMPI, Artificial Intelligence and Health/Social Care in the UK

The EPSRC-funded Self-Care Advice, Monitoring, Planning and Intervention (SCAMPI) Consortium is researching new artificial intelligence technologies to support people with chronic diseases to improve the quality of their lives at home. Until 2020, it will develop and evaluate automated planning, reasoning and sensing technologies to support people with two conditions – dementia and Parkinson's disease – to enable them to plan and monitor their lives and care at home. These technologies will then be evolved and rolled out to support people with other chronic health conditions. It is hoped that SCAMPI will have significant future impact on people with chronic diseases and their families by using artificial intelligence in everyday health management decisions, and on third-sector organisations seeking to leverage these new technologies to solve critical health and social care challenges.

SCAMPI's new uses of artificial intelligence to support social care are important. The project is one of the few in the UK to deploy artificial intelligence in social care to empower people with new knowledge and capabilities, rather than to automate and replace these people. To respond to the Select Committee, SCAMPI draws on its knowledge and expertise from the perspectives of social care and related healthcare research. Key SCAMPI recommendations are:

1. Enable and educate the general public to take ownership of their personal health and social care data, as part of their active care and life planning;
2. Ensure that health and social care professionals are equipped to understand, procure and deploy artificial intelligence and machine learning through suitable informatics education and training;
3. To reduce the potential for incorrect decisions, increase the transparency of artificial intelligence algorithms to enable public scrutiny and oversight and intervention by health and care professionals;
4. Determine the mix of regulatory and procurement action necessary to ensure that black-box artificial intelligence does not deny people access to information generated from their own datasets – a risk to the ethical ownership of people's data;
5. Work with social care commissioners and providers to create opportunities for UK-based artificial intelligence research enterprises to support the sector realise the potential of these technologies; and
6. Regulators need to future proof the way they regulate. The changing landscape needs to be mapped against the scope Parliament has determined for each relevant regulator.

1. What is the current state of artificial intelligence and what factors have contributed to this? How is it likely to develop over the next 5, 10 and 20 years? What factors, technical or societal, will accelerate or hinder this development?

The state of artificial intelligence research and development is more advanced than most people in the general public believe, and in directions that most members of the general public do not recognise. Indeed, older artificial intelligence technologies in use are often not treated as such, for example the use of fuzzy logic in implantable devices such as pace makers. There are more established artificial intelligence developments in healthcare than in social care, and include opportunities to analyse big data quickly and reliably:

- Case-based reasoning and pattern recognition technologies that emulate how clinicians and other healthcare professionals reason, for example for diagnosis, decision support and care scheduling, from oncology to medical imaging. Machines pattern-match very effectively, leading to new potential for these algorithms to be applied to patient records more broadly, for example for screening for diseases by Deep Mind Health [1];
- Image analysis technologies, for example for spotting tumours and identifying skin cancer [2] and choosing successful IVF embryos [3];
- Natural language processing technologies applied to, for example, mining medical literature to provide decision support to treat cancers and discover new medical drugs [12] and medical chat-bots, as being trialled with the NHS [8];
- Multivariate analysis, which allows for contextual decision-making that is critical to people delivering good healthcare and social care. For example, NICE have used multinomial logistic regression to perform health technology assessment and is the decision making process that governs funding for health care systems [9].

There are limited applications of robotics as examples of autonomous artificial intelligence, for example to deliver mechanised companionship to older people with the *Paro* seal robot.

Developments to support social care are more modest, but include:

- The SCAMPI consortium's case-based technologies support creative thinking to manage challenging behaviours exhibited by people with dementia [4];
- Contextual and shared decision-making that is critical to delivering good social care.

SCAMPI predicts two factors to accelerate this development in the next 5-15 years:

- Synthesis of diverse technologies and data sources from different research disciplines is now possible. Moreover, the emergences of the Internet of Things and social media has enabled the simple, effective and scalable integration of different artificial intelligence technologies and data sources to support diverse health care and social care tasks;
- The strategic shift in healthcare from diagnosis and treatment, to wellness and prevention and self-care. For example, patient-centred applications already use the Internet of things, telemedicine and personalized care with available consumer devices such as the Fitbit and iPhone. Most perform trend analysis using captured data that can be inputs to existing and new artificial intelligence mechanisms. Example applications include Cellscope's digital otoscope [5] and AliveCor Kardia [6] - both add sensors to smartphones so that consumers can monitor ear infections or atrial fibrillation respectively.

To conclude, SCAMPI predicts new applications of artificial intelligence that integrate data from multiple sources to support people to deliver and to receive more personalised healthcare and social care. The focus will be to support, collaborate about and learn, rather than to automate care tasks.

2. Is the current level of excitement that surrounds artificial intelligence warranted?

Yes, it is warranted, but much of the research and development is misunderstood by most who are not familiar with the technologies. Most public debate is oversimplified, and focuses too much on robotics and on full automation of tasks that are currently undertaken by people at the exclusion of technologies that seek to enhance essential human skills. For example, in the social care sector, the scope for robots and the automation of carer activities are limited, let alone cost-effective, for most UK citizens and care services.

Instead, SCAMPI argues that, instead, greater benefits can accrue from focusing on technologies to enhance human knowledge and capabilities – technologies and people cooperating – rather than on automation. It also places a premium on the relational aspects of care and support and the quality of the human interaction. This might create fewer news headlines, but is a key direction of travel. Current examples of such technologies in healthcare and social care include the remote monitoring of people's health by healthcare professionals such as the TIHM project in Surrey [10], the use of telemedicine technologies, and personalised reminiscence therapy apps for people with dementia.

3. How can the general public best be prepared for more widespread use of artificial intelligence?

There are different ways in which the general public can be prepared:

- Enhance awareness of what artificial intelligence is and how it is already been used, under people's control, in everyday activities. Once these technologies are established and accepted by most people, they are rarely considered to be artificial intelligence per se. Government has a role in educating the public as the presence, nature and uses of these artificial intelligence technologies – uses which are overwhelmingly benign rather than dangerous;
- Enable and educate the general public to take ownership of their personal health and social care data, as part of their active care and life planning;
- Ensure that healthcare and social care professionals who will interact with artificial intelligence systems are up-skilled to understand and exploit these technologies e.g. through health informatics education and training.
- Increase the transparency of artificial intelligence algorithms to enable public scrutiny and professionals to intervene, to reduce algorithm bias and the potential for incorrect decisions;
- Enable a deeper understanding of the ethical implications of using artificial intelligence in healthcare.

4. Who in society is gaining the most from the development and use of artificial intelligence and data? Who is gaining the least? How can potential disparities be mitigated?

SCAMPI argues that the UK public sector, and in particular UK social care, is currently benefiting little from the development and use of artificial intelligence, as few initiatives have been funded or reported. Instead, most current artificial intelligence serves business interests, particularly in industries such as automotive manufacturing, which can adopt automation quickly, and the needs of consumers with purchasing power, for example through easier access to information, improved decision making for purchases and greater convenience, as demonstrated by Amazon's online selling algorithms.

Artificial intelligence also rarely serves socially disadvantaged people and groups, for several possible reasons. Socially disadvantaged groups tend to lack the access to basic technologies needed to access artificial intelligence. There is little financial incentive for technology companies to invest in this sector, due to both the limited financial returns that are available and the funding crisis – a crisis that means that the sector is changing and evolving [11].

5. Should efforts be made to improve the public's understanding of, and engagement with, artificial intelligence? If so, how?

Efforts should be made. Most members of the generic public know about artificial intelligence from news media, social networks and television and movies. Therefore:

- These different media need to present factual information about artificial intelligence, rather than alarmist stories about robots, automation and mass unemployment;
- Seek to educate the general public that most artificial intelligence will be developed to support and cooperate with, rather than automate and replace people, as countless examples of such technologies in healthcare demonstrate. Explain how hand-over or mixed-initiative control can already be coordinated between human and artificial intelligence, to show how people can take charge of these technologies when needed;
- Demystify with new white-box demonstrators that describe and explain exactly how systems operate in key domains such as education and healthcare, and where the intelligence is derived from;
- Direct software developers to build in more explanations of their artificial intelligence products and their outcomes, to encourage greater understanding, and encourage the public to use then create and customise their own artificial intelligence technologies, especially if it concerns their own healthcare and social care information.

6. What are the key sectors that stand to benefit from the development and use of artificial intelligence? Which sectors do not?

The focus of SCAMPI is on social care, and to support and empower people, their families and their carers, rather than to automate complex care tasks and replace human carers. It is a key sector that stands to benefit. Alas, this is not a priority in artificial intelligence research and applications, due to relative lack of return on investment, and hence funding in the sector. The artificial intelligence providers have little real understanding of healthcare and social care challenges. And it remains difficult for traditional sectors like health to recruit the expertise needed to develop artificial intelligence solutions, due to the cross-discipline knowledge and expertise required.

8. What are the ethical implications of the development and use of artificial intelligence? How can any negative implications be resolved?

Careful note has to be taken to reduce bias in artificial intelligence, to avoid simply replicating current decision-making and data collection biases. Existing biases in healthcare, and to a lesser extent social care data, exist because most data has been collected from white males, and which skews the analysis of data is skewed to that population, for example [7]. As a consequence, artificial intelligence technologies risk deepening the emerging digital divide. Disparities can be mitigated through:

- Raising awareness in artificial intelligence researcher companies to the opportunities that exist to support social care and overcome some of its challenges;
- Treating social care change as a complex social-political problem that artificial intelligence is only a partial solution to;
- Encouraging and supporting new forms of social enterprises and/or business models to deliver artificial intelligence technologies to social care and healthcare.

Moreover, black-box artificial intelligence can deny people access to information generated from their own datasets – a risk to the ethical ownership of people's data.

9. In what situations is a relative lack of transparency in artificial intelligence systems (so-called 'black boxing') acceptable? When should it not be permissible?

SCAMPI argues that, for the healthcare domain, black boxing is not acceptable. The details about how outcomes are computed, and thus can be explained, matters for most applications of artificial intelligence in this area.

10. What role should the Government take in the development and use of artificial intelligence in the United Kingdom? Should artificial intelligence be regulated? If so, how?

The technology enabled care sector is largely unregulated and is only partially subject to industry standards. Therefore, there is a place for regulation in the uses of artificial intelligence in the delivery of health and social care. In England the Care Quality Commission has already considered a number of artificial intelligence-based services, mostly in primary care. Care regulators in each of the home nations need to be equipped with the necessary skills and capabilities to provide the public assurance.

Regulation needs to be independent of technology change and focused on how risk is managed, safety assured and how the outcomes of people using services are fulfilled. However, where artificial intelligence is developed to support and cooperate with people who require care and support and with health and care staff regulators need to be able to understand the role the artificial intelligence is playing in care processes and outcomes.

Currently, there is some ambiguity about where the contribution of industry standards end and statutory regulation start. Regulators need to future proof the way they regulate. The changing landscape needs to be mapped against the scope Parliament has determined for each relevant regulator. This would provide assurance that there are no unintended gaps in what is regulated and that the responsibilities of different regulators are clear.

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