8

Technological Innovations in Care and Implications for Human Resource Development

Louise Oldridge

8.1 Introduction and Purpose

Alongside many other countries, the UK faces a well-reported unsustainable crisis of care, with more people needing care, a dearth of skilled workers and an increasing reliance on friends and family, with unpaid care estimated to save the state £132 billion per year (Carers UK 2017). This crisis has been heightened by the impact of Brexit’s (the UK leaving the European Union) immigration requirements and the global Covid-19 pandemic. Indeed, the UK’s health and social care system is adopting new technology in its efforts to manage the Covid-19 response (NHSX n.d.-b).

The purpose of this chapter is to explore technological innovations in care and their implications and responses for human resource development (HRD) in organisations. In so doing, it contextualises the provision of care with a focus on the UK and exploring current challenges and the

L. Oldridge (✉)
Nottingham Trent University, Nottingham, UK
e-mail: louise.oldridge@ntu.ac.uk

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role of technology which is seen as a solution to ongoing care crises. It seeks to examine the types of technological innovations available to support care practices and evaluate the effect of technological advances on human resources. It concludes by considering the implications of the use of technology in care on HRD practices in organisations but also recognising it will not automatically solve crises in care. As a result, the chapter also calls for policymakers to review the careful implementation of technological innovations in care and recognise that technology alone will not resolve resourcing issues.

8.2 Contextualising Care and Technology

Care and caring are an integral part of human life globally, for which many countries are facing increased demand (Yeandle et al. 2017). Conceptually, ‘care is both a public and a private concern; it affects family members and paid workers; it concerns labour and love; it involves intimate practices, technical skills and challenging tasks that must respect a care recipient’s dignity and comply with externally determined quality standards; and it is delivered “in the moment” but may be the product of a lifetime of interactions’ (Yeandle et al. 2017, p. 9).

The UK Government has a Department of Health and Social Care. Within this, healthcare involves the provision of medical care, through the publicly funded National Health Service (NHS). Social care involves the support of daily living activities, including personal care and social support, and is typically self-funded and funded by local authorities (although mostly outsourced to care providers) and third-sector organisations (Dam 2019; HM Government n.d.). The term carer is used to refer to those providing care on an informal and unpaid basis, usually for family members or friends who, due to illness, disability, a mental health problem or an addiction, cannot cope without their support (Carers Trust 2015). Paid care workers are considered professionals working in exchange for pay in a range of settings including home, residential care and nursing homes (The Care Workers Charity 2019). This chapter the provision of care by paid workers in both health and social care settings, and not specific medical treatments.
Many countries, such as the UK, are seeing ageing populations with greater chronic illnesses, lower fertility rates, an increase in women’s labour force participation and greater mobility of people (Yeandle et al. 2017; Meskó et al. 2018). Across economically developed countries state welfare provisions have been put in place, albeit with developments in the outsourcing of care, and individuals privately purchasing their own care arrangements through direct payment schemes with funding received at a local level (Yeandle et al. 2017). Yet, existing health and social care requirements, even in countless middle- and high-income countries, are unsustainable without informal care provision (International Labour Organisation 2018; Pickard 2008). Numerous neoliberal government policies continue to rely on informal, and unpaid, care by friends and family to meet increasing demand (International Labour Organisation 2018). Recognising the multiple ways in which care and carers are conceptualised and the different activities associated with care, it is challenging to provide an exact figure but the Economic Commission for Europe (2019) proffer that, globally, unpaid/informal carers meet 70–95% of all care requirements. It is projected that the population of those aged 85 or over in the UK will increase to around 3.2 million by 2041. Additionally, with less in residential care, the amount of older people owning their own home has increased while budget cuts mean the supply of social care has decreased (Stewart and MacIntyre 2013; Heitmueller 2007). It is estimated that by 2030 the number of persons in receipt of care globally will be 2.3 billion, in part due to an additional 0.1 billion older people, although this figure does include childcare (ILO 2018).

Alongside health and social care budget constrictions, with an ageing workforce and increased requirements, there is a global shortfall of 17.4 million healthcare workers (World Health Organisation 2016 cited in Meskó et al. 2018). In the UK, a healthcare workforce gap has been described as the biggest issue facing the NHS and it has an impact on care provision. There are estimated to be 1.2 million full-time equivalent staff employed by the NHS and 1.1 million in adult social care (Macdonald 2020). In both cases, the current vacancy rate is approximately 8% compared with the overall UK economy at 3%. Migrant workers are key to addressing this shortfall and as of June 2019 there were 78,000 European Union national adult social care workers (Macdonald 2020). However,
the UK’s points-based immigration system introduced in the wake of Brexit, effective from January 2021 (HM Government 2020a), indicates that many jobs in adult social care do not meet the skills and salary threshold which could have major implications on the gaps in provision already experienced. The Covid-19 pandemic, with many countries in lockdown at the time of writing, highlights both formal and informal care work, labour market gaps, fragmented social care provision and long-term funding and resourcing issues, exposing further the UK’s care crisis (Bedford 2020; Jones 2020; Kuenssberg 2020).

In September 2019, the House of Commons Library issued a briefing paper on the ongoing delay to the Green Paper for social care (first due to be published in the summer of 2017), which could be expected to address issues of funding, scenarios influenced by technology and the impact on markets given the outsourcing to the private sector (Jarrett 2019). The NHS’ long-term plan, published in January 2019, referred to digital technology enabling patients’ access to care. Indeed, in recent years technological solutions have been seen as a way for older and disabled people to live more independently and to address gaps in care and availability of human resources (Yeandle et al. 2017), creating smarter and more efficient processes (Hansen and Grosen 2019). Furthermore, the UK Government published a policy paper in October 2018 stating, ‘Our ultimate objective is the provision of better care and improved health outcomes for people in England. But this cannot be done without a clear focus on improving technology’ (HM Government 2018). Since then, the government has made investments in researching technological advancements in care; for example, investing £34 million in looking at autonomous systems to help with the tasks and activities associated with caring for someone, including assistive robots (HM Government 2019). They have also established NHSX—a multidisciplinary team, including clinicians, technologists and policy experts reporting to the Secretary of State, NHS England and NHS Improvement, tasked with leading a digital health and social care transformation with a £1 billion investment. They report that one of their missions is to ‘reduce the burden on our workforce so they can focus on delivering care’ (NHSX n.d.-a).

Such technologies require a review of the skills and competencies of workers to support care provision (Barakat et al. 2013) and a review of
organisational processes and culture (Barakat et al. 2013; Kitzmiller et al. 2013). Workers can be overlooked during the development and implementation of technological advances despite the fact that new technologies can lead to a change in practices and care labour (Saborowski and Kollak 2015). In their paper on human resource management in a healthcare environment, Ramadevi et al. (2016) surmised that hospital staff and healthcare workers could lack training in technology. Additionally, Mohammed et al. (2018) pointed to low levels of information technology skills and abilities in the social care sector. Given that worker behaviour is directly related to care receiver experiences it is important to pay attention to the impact of technology in care on HRD (Ramadevi et al. 2016); its systematic implementation (Anvari 2007); updated person and job specifications recognising revised roles and responsibilities (Mohammed et al. 2018); and necessary training (Saborowski and Kollak 2015). First, this chapter explores some of the current technological innovations in care which are proposed as solutions to ongoing care crises but must be considered alongside resourcing and investment in the sector.

8.3 Types of Technological Innovation in Care

Digital technology has the functionality to be able to offer up-to-date information about care receivers/patients to assist workers in the delivery of more person-centred care (Maiden et al. 2013). Technology offers the opportunity to store electronic health records which are easily accessible and patient self-monitoring to drive decision-making (Barakat et al. 2013). Some health information technology systems can also automate processes such as ordering prescriptions (Hitt and Tambe 2016). Mobile devices, and computers in particular, can offer a single source of information for a patient/resident in care reducing the amount of information for a worker to remember (Maiden et al. 2013). Applications can also be used to assist, such as Carer which could be used in care homes for workers to reflect on resident behaviour, review existing information and reason the appropriate course of action and resolution (Maiden et al. 2013).

Assistive technologies can provide support not only for individuals but also for care workers. At an individual level they include developments
such as lifting and transfer assistance (Saborowski and Kollak 2015) and wash-and-dry toilets (Hansen and Grosen 2019) for example. At an information technology level they include emergency call systems, nursing call systems, sensor mats to track movements from beds and home automation systems (Saborowski and Kollak 2015).

Virtual reality can offer a meaningful training experience simulation for healthcare workers to be able to interact with patients (Balistreri and Casile 2020). Recent developments have seen the implementation and use of artificial intelligence (Meskó et al. 2018). Artificial intelligence can be categorised into three stages: artificial narrow intelligence (performance of a single task); artificial general intelligence (can understand its operating environment similar to a human); and artificial superintelligence (arguably smarter than humans) (Bostrom 2014, cited in Meskó et al. 2018, p. 2). It is surmised that, in the coming years, there will be a rise in the use of artificial narrow intelligence, assisting in diagnoses, administration, data analytics and education (Meskó et al. 2018). Indeed, artificial intelligence could support messaging applications and voice-controlled chatbots could ease healthcare worker burden by diagnosing health conditions (Meskó et al. 2018). Already, Safedrugbot is a chat messaging service which offers information on the use of drugs while breastfeeding (Meskó et al. 2018).

Robots can both help in the delivery of care and also in training of healthcare workers by practising skills on the robots which have been programmed to interpret different ages and characteristics of possible patients. This includes technical skills, behaviours and assessment of communications (Balistreri and Casile 2020). Attention has been drawn to the use of robots in care with three well-known examples which were looked at in a study of an elderly care home in Japan. They included Pepper the humanoid robot from Softbank Robotics; the Hug lifting robot from Fuji Machine Manufacturing; and Paro the seal communication therapy robot from Intelligent Systems (Wright 2019).

Pepper’s ‘social’ robot humanoid form is moveable with head, arms, hands and fingers, and on a base which can move to demonstrate exercises. It has eyes which can light up, microphones and speakers to enable communication, cameras and a touch screen. Pepper can speak in Japanese and English. Pepper is marketed as a multipurpose service robot
and can be used in care in a number of ways. Pepper is said to be able to emotionally engage with those around it (Wright 2019). In Wright’s (2019) study, Pepper was used in recreation, using an exercise application, in the Japanese care home to supplement, but not replace, human labour. Indeed, care residents would engage with the exercises led by Pepper only if staff stood alongside Pepper mimicking the exercises (ibid., 2019).

Meanwhile, Paro is a robot made to look like a baby seal, responding to the touch of its fur, moving its head, eyes and flippers (Dickinson and Swift 2018). Paro has been used in elderly care to provide comfort, particularly among those with dementia in areas of Asia, Europe and the USA (ibid., 2018).

At the time of writing, in response to Covid-19, in the UK NHSX is collaborating with technology companies to provide resources to reduce social isolation and support the NHS and social care provision. This includes communication devices, technological solutions to support staff working remotely and virtual medical appointments (HM Government 2020b), and incorporates not only software already widely used such as Microsoft Teams and online rota systems but also new tools and products (Digital NHS 2020; Digital Social Care n.d.-a, b). One such example of a new innovation is ‘C19 Control’—an application developed by everyLIFE to assist carers and care workers to support screening, status tracking and reporting, and provision of Personal Protective Equipment (C19 Control 2020). On the NHSX website, the Covid-19 response is said to need ‘large scale, system-wide collaboration combined with the best possible technology and access to information. The health care system is working in unison, adopting new technology and enhancing the flow and collection of data to enable staff to deliver the best care’ (NHSX n.d.-b). Use of technology is thus seen as a strategic resource in the UK’s Covid-19 response.
8.4 Benefits

As identified earlier, technology has been seen to be a solution to the ongoing care crises across the globe and there are a number of operational and service-level benefits. These include assisting diagnoses, decision-making, analysis and administration (Meskó et al. 2018). Information technologies can improve documentation and record keeping (Hitt and Tambe 2016). In a study in 2016 with nursing homes, Hitt and Tambe (2016) found that use of electronic medical records led to 1% higher productivity and 3% greater efficiency, albeit there was not an impact on quality of care. Furthermore, technology, such as care robots, does not need breaks and rest as human workers do and it has been argued that it could provide accurate, reliable and consistent health monitoring and assistance, allowing for a more rounded observation of care requirements (Barakat et al. 2013; Hitt and Tambe 2016). Balistreri and Casile (2020) suggested that robots could remind individuals which and how much medication to take, for example, alongside cognitive stimulation and robots such as Pepper and Paro can promote social interaction (Dickinson and Swift 2018). Care robots could assist in repetitive tasks and activities and minimise physical strain including lifting and offering recipients more independence; all of this can ultimately lead to the freeing up of carers and care workers to provide more complex care provision and emotional support (Balistreri and Casile 2020; Ajslev et al. 2019; Bjerke Batt-Rawden et al. 2017; Barakat et al. 2013).

8.5 Consequences and Issues

Nonetheless, technology has been reported to prohibit care and cause issues for workers. Saborowski and Kollak (2015) examined care professionals’ experiences with assistive technology in caring for elderly persons in Berlin, Germany. Interview participants reported a lack of reliability in technology and that devices malfunctioned. They also spoke of the length of time it can sometimes take to get technology working or to use it in a new way. An example was given of lifting technology where a participant
reported it was quicker to ask a colleague for help. This finding is not isolated, with Ajslev et al. (2019) also reporting use of technology as time consuming by participants in their study on use of technology in Danish care homes, leading to workers creating workarounds. This has implications for professional identity and activities, something also found by Wright (2019).

Saborowski and Kollak’s (2015) interviewees also spoke of a lack of competence or training, and technology which was too complex for their use. Similarly, Bjerke Batt-Rawden et al. (2017) followed the implementation of new digital alarm devices from a case study in Norway and found that information on the new devices to staff was inconsistent, leading to uneven adoption and several participants reporting they were in need of training and did not feel comfortable to use the new technology.

Arguably, technological advances and use of artificial intelligence does not replace the requirement of human resources in care. Meskó et al. (2018) assert that the human touch, communication and empathy are still necessary. Certainly, literature on the subject of technology in care often refers to it not being able to replace people (Wright 2019; Bjerke Batt-Rawden et al. 2017; Saborowski and Kollak 2015), sometimes increasing requirements and sometimes acting as a barrier to the provision of human care. Following a study on the use of robots in a Japanese care home, Wright (2019) argues that the use of care robots is dependent on an increasing amount of human labour whilst also deskillng key tasks. While the care home manager in Wright’s (2019) study on Pepper the robot felt that the robot would be better qualified to run recreation sessions than his own staff, residents were reticent to join in exercise without a human worker alongside Pepper. Pepper was not to be used as a stand-alone robot but required human assistance, with reference to time taken up having to be physically moved around, watched in case of technological issues and some issues with processing what was said to it, ultimately requiring more human labour, not less. Wright concluded, ‘the introduction of care robots displaces skills and practices; their meditation displaces human-human contact; caring for robots displaces caring for people’ (ibid., p. 350).

As literature has reported, organisations must also be aware of the possible, and sometimes unintended, consequences of implementing new
technology on care workers. This includes disrupting existing work routines, blurring role boundaries and reallocation of work, as found by Edmondson et al. (2001) in their study on the implementation of technology for cardiac surgery. Furthermore, it can lead to changes in communication and interpersonal working relationships among staff as roles and responsibilities are adapted (Edmondson et al. 2001; Beuscart-Zephir et al. 2005 cited in Kitzmiller et al. 2013; Campbell et al. 2006 cited in Kitzmiller et al. 2013; Koppel et al. 2005 cited in Kitzmiller et al. 2013). Indeed, Mohammed et al. (2018) reported that much of the literature on technology in care demonstrates an inability to effectively implement and utilise technology, particularly with reference to the worker as the end user (Bhattacherjee and Hikmet 2007 cited in Mohammed et al. 2018, p. 268). Given the importance of the role of care workers in using technology it is disappointing that, in their research, Dickinson and Swift (2018) found a lack of strategic approach in implementation, and the use of technology in care was being driven by the interests of the suppliers not users. As a result, they called for a responsive regulatory approach and industry standards by governments (Dickinson and Swift 2018).

With financial resources already an issue in both the NHS and social care in the UK, it is worth noting that literature also points to the investment in technology leaving less money available to pay for and hire human resources (Wright 2019; Saborowski and Kollak 2015). Such technologies may also be too costly for developing countries (Meskó et al. 2018). Evidently, attention must be paid to the implications for implementing technology on workers and, ultimately, HRD as the next section explores.

8.6 Implications for HRD Practice

Technological innovations in care interact with workers’ identities, values, skills and roles (Ajslev et al. 2019). The last section looked at some of the issues including, in some cases, notions of impeding care provision changing required skills; thus it is important to pay attention to the implications for HRD practice as changing demands may influence
‘opinion on what skills are needed to be a good care worker’ (Ajslev et al. 2019, p. 24), and also considerations must be made at policy level.

Organisations must give due care and attention to the implementation process when introducing technology. In their paper, Barakat et al. (2013) refer to Rogers’ ‘Diffusion of Innovations’ theory (ibid., p. 2), which notes four key elements that inform the adoption of a new idea: (1) innovation, (2) communication channels, (3) time and (4) social system. Information and knowledge on new technology in care should be equally disseminated and the technology consistently adopted (Bjerke Batt-Rawden et al. 2017), recognising that implementation is a process that changes existing working routines. From their data, Edmondson et al. (2001) suggested a model of: (1) mindfully select the team, (2) carefully trial the technology and communicate, (3) encourage communication while examining the effect on work behaviours and (4) evaluate and reflect, with team and senior leadership on board throughout, to provide a culture of learning.

Notwithstanding that use of technology is not necessarily considered the focus of a care worker, or integral to care worker training, organisations must educate and train care workers in the use of new technological advances (Ajslev et al. 2019; Saborowski and Kollak 2015; Barakat et al. 2013). With increasing developments, the necessary skills and competencies need to be established and developed among workers (Barakat et al. 2013). Indeed, technologies can develop professional expertise and lead to upskilling (Ajslev et al. 2019). Barakat et al. (2013) reported from a workshop of international academics with experience of working with, developing and evaluating eHealth technologies (electronic communication and information technology such as health records, assisted living and smart systems) and proposed a number of skills and competencies which they felt healthcare workers would require. These includes basic skills in using the technology and hardware; interpretation and analysis of data produced (such as health condition observations) to inform care decisions; ability to provide guidance and support to service users (e.g., care recipients using self-monitoring devices); effective communication skills; and privacy and confidentiality of data around care recipients. It must be noted, however, that these findings are based on academic
opinion and would be bolstered by further research with key stakeholders, such as the workers themselves.

Mechanisms should be in place for assessing skills gaps and training and development needs (Barakat et al. 2013). Detailed introductions should then be provided for any new technology and promoted through training with regular reviews (Saborowski and Kollak 2015). It is also worthwhile considering appointing some super-users with additional knowledge and training (Bjerke Batt-Rawden 2017).

It has been noted that information technology in healthcare is most effective when organisations embody work practices which empower workers to use problem-solving skills and facilitate information sharing (Hitt and Tambe 2016). Indeed, technological innovations will influence work design and division of responsibilities (Saborowski and Kollak 2015), with workers understandably nervous about redistribution of tasks and activities (Bjerke Batt-Rawden et al. 2017). Thus, it is important to consider the systematic integration into existing work practices.

Given the aforementioned challenges in the health and social care sector, investment in workers is key, particularly as the use of technology indicates changes in requirements and sometimes greater skills, rather than less human capital (Ajslev et al. 2019). At an individual level, the technology needs to be used and accepted by workers (Mohammed et al. 2018) which will be more successful with careful consideration of implementation. Studying technology acceptance in care settings in nine social service organisations in the south west of England, Mohammed et al. (2018) found that users will create positive intentions to use technology if it is perceived as being useful and is impacted by existing information technology skills and access. Therefore, this includes ensuring the appointment of workers who meet the role requirements, an assessment of training needs and designing appropriate solutions (Barakat et al. 2013). It is evident that team leaders and line managers have an important role to play in the implementation process of innovation and how technology is positioned in terms of impact on work design and behaviours and providing space for open communication and ensuring the culture is conducive to change (Barakat et al. 2013; Kitzmiller et al. 2013; Edmondson et al. 2001). They must work hard to carefully and systematically integrate technology into workers’ existing work practices (Barakat...
et al. 2013) and consult with them on changes to tasks, activities and responsibilities, providing sufficient information and recognising it could be anxiety-provoking for workers and that they may have differing levels of skills, expectations and approaches to technology (Bjerke Batt-Rawden 2017). Roles and responsibilities should be regularly reviewed with updated job descriptions and role profiles to account for the development in skills (Mohammed et al. 2018; Bjerke Batt-Rawden 2017).

Outside of organisations, as noted by Dickinson and Swift (2018), government policy needs to regulate the technology market and consider the needs of workers who will be engaging with technology, particularly as it has the potential to change care labour (Saborowski and Kollak 2015). Furthermore, with increasing health and care requirements, attention must be given to the provision of necessary skills and competencies in education and training for workers in the health and social care sector, especially as worker behaviour impacts the experiences of those receiving care (Ramadevi et al. 2016). It is important to recognise the additional requirements of technology, in light of health and social care depending on migrant labour and Brexit’s skills-based immigration policies.

### 8.7 Conclusion

In the UK, outside of the NHS care work is poorly understood and undervalued, highlighted by the government’s position on skills in the wake of Brexit. Technological advances have been proposed as a solution to ongoing crises in care. The purpose of this chapter was to explore technological innovations in care and their implications and responses for HRD in organisations. This chapter has contextualised the UK’s health and social care system and a number of existing innovations. It has illustrated not only some of the benefits of various forms of technological advances but also some of the challenges and implications for workers. Realistically, technology cannot replace people, their emotional intelligence, empathy, communication and care provision. While there is a shortage of skilled workers, care work can only be supplemented, not replaced, by technology. With more innovations in the care sector and the assistance of technology, key stakeholders such as workers should be
greatly involved in technological development and implementation. This includes careful and systematic introduction and communication, and identification of needs and training provision supported by organisational culture open to change and taking account of revised roles and responsibilities and supporting infrastructure. With an existing shortage of workers, government policy should address the changing skills and competencies required and also ensure appropriate and sustainable funding and resourcing of the sector as promised in the NHS long-term plan and through the hugely delayed social care green paper. Ultimately, while often portrayed as such, technology is not an immediate fix to care crises.

References

Ajslev, J., Johansen, H., Anderson, M., Poulsen, O. and Anderson, L. 2019. Occupational Identities and Physical Exertion in (re)configurations of New Technologies in Eldercare. Nordic Journal of Working Life Studies, 9(4), pp. 19–37.

Anvari, M. 2007. Impact of Information Technology on Human Resources in Healthcare, Healthcare Quarterly, 10(4).

Balistreri, M. and Casile, F. 2020. Care Robots: From Tools of Care to Training Opportunities. Moral considerations. In Methodologies and Intelligent Systems for Technology Enhanced Learning, Edited by Popescu E., Belén Gil A., Lancia L., Simona Sica L., Mavroudi A. (eds), 9th International Conference, Workshops. MIS4TEL 2019. Advances in Intelligent Systems and Computing, vol 1008. Springer, Cham.

Barakat, A., Woolrych, R. Sixsmith, A., Kearns, W. and Kort, H. 2013. eHealth Technology Competencies for Health Professionals Working in Home Care to Support Older Adults to Age in Place: Outcomes of a Two-Day Collaborative Workshop. Medicine 2.0, 2(2).

Bedford, S. 2020. Covid-19 exposes our failing care system, New Economics Foundation https://neweconomics.org/2020/03/care-and-covid-19 (Accessed on 2 May 2020).

Beuscart-Zephir, M. C., Pelayo, S., Anceaux, F., Meaux, J. J., Degroisse, M., and Degoulet, P. 2005. Impact of CPOE on doctor-nurse cooperation for the medication ordering and administration process. International Journal of Medical Informatics, 74(7–8), 629–641. https://doi.org/10.1016/j.ijmedinf.2005.01.004.
Bhattacherjee, A., & Hikmet, N. 2007. Physicians’ resistance toward healthcare information technology: A theoretical model and empirical test. *European Journal of Information Systems*, 16, 725–737.

Bjerke Batt-Rawden, K., Björk, E. and Waaler, D. 2017. Human factors in the implementation and adoption of innovations in health care services. A longitudinal case study on the introduction of new technology. *The Innovation Journal: The Public Sector Innovation Journal*, 22(3), pp. 2–25.

Bostrom N. 2014. *Superintelligence: Paths, dangers, strategies*. Oxford: Oxford University Press.

C19 Control. 2020. *C19 Control*. [https://www.c19control.com/](https://www.c19control.com/) (Accessed 14 May 2020).

Campbell, E. M., Sittig, D. F., Ash, J. S., Guappone, K. P., and Dykstra, R. H. 2006. Types of unintended consequences related to computerized provider order entry. *Journal of the American Medical Informatics Association*, 13(5), 547–556.

Carers Trust, 2015. *About carers*. [https://carers.org/what-carer](https://carers.org/what-carer) (Accessed on 14 December 2019).

Carers UK. 2017 *State of Caring 2017*. London, Carers UK.

Dam, D. 2019. *What is the difference between healthcare and social care?* [https://www.st-patricks.ac.uk/blog/posts/2019/april/what-is-the-difference-between-healthcare-and-social-care/](https://www.st-patricks.ac.uk/blog/posts/2019/april/what-is-the-difference-between-healthcare-and-social-care/) (Accessed on 1 May 2020).

Dickinson, H. and Swift, S. 2018. *Before replacing a carer with a robot, we need to assess the pros and cons*, The Conversation. [https://theconversation.com/before-replacing-a-carer-with-a-robot-we-need-to-assess-the-pros-and-cons-106160](https://theconversation.com/before-replacing-a-carer-with-a-robot-we-need-to-assess-the-pros-and-cons-106160) (Accessed on 2 May 2020).

Digital NHS. 2020. *Coronavirus (COVID-19) increase in use of NHS Digital tech*. [https://digital.nhs.uk/coronavirus/nhs-digital-tech-analytics](https://digital.nhs.uk/coronavirus/nhs-digital-tech-analytics) (Accessed 14 May 2020).

Digital Social Care. n.d.-a. *Covid-19 Guidance*. [https://www.digitalsocialcare.co.uk/covid-19-guidance/](https://www.digitalsocialcare.co.uk/covid-19-guidance/) (Accessed 14 May 2020).

Digital Social Care. n.d.-b. *Free Digital Tools/Resources for Covid-19*. [https://www.digitalsocialcare.co.uk/covid-19-guidance/free-digital-tools-resources-for-covid-19/](https://www.digitalsocialcare.co.uk/covid-19-guidance/free-digital-tools-resources-for-covid-19/) (Accessed on 14 May 2020).

Edmondson, A., Bohmer, R. and Pisano, G. 2001 Disrupted Routines: Team Learning and New Technology Implementation in Hospitals, *Administrative Science Quarterly*, 46(4), pp. 685–701.
Hansen, A. and Grosen, S. 2019. Transforming Bodywork in Eldercare with Wash-and-dry Toilets. *Nordic Journal of Working Life Studies*, 9(S5), pp. 49–67.

Heitmueller, A. 2007. The chicken or the egg? Endogeneity in labour market participation of informal carers in England. *Journal of Health Economics*, 26(3), pp. 536–559.

Hitt, L. and Tambe, P. 2016. Health Care Information Technology, work, organization, and nursing home performance. *ILR Review*, 69(4), pp. 834–859.

HM Government, 2018. *The future of healthcare: our vision for digital, data and technology in health and care* https://www.gov.uk/government/publications/the-future-of-healthcare-our-vision-for-digital-data-and-technology-in-health-and-care (Accessed on 2 May 2020).

HM Government, 2019. *Care robots could revolutionise UK care system and provide staff extra support* https://www.gov.uk/government/news/care-robots-could-revolutionise-uk-care-system-and-provide-staff-extra-support (Accessed on 2 May 2020).

HM Government, 2020a. *The UK’s points-based immigration system: policy statement* https://www.gov.uk/government/publications/the-uks-points-based-immigration-system-policy-statement (Accessed on 2 May 2020).

HM Government, 2020b. *NHS works with tech firms to help care home residents and patients connect with loved ones* https://www.gov.uk/government/news/nhs-works-with-tech-firms-to-help-care-home-residents-and-patients-connect-with-loved-ones?utm_source=4739fde5-2940-4e76-bb87-dfb177309b37&utm_medium=email&utm_campaign=govuk-notifications&utm_content=immediate (Accessed on 1 May 2020).

HM Government, (n.d.). *Department of Health & Social Care—About us* https://www.gov.uk/government/organisations/department-of-health-and-social-care/about. (Accessed on 1 May 2020).

International Labour Organization, 2018. *Care work and care jobs for the future of decent work*, https://www.InternationalLabourOrganisation.org/wcmsp5/groups/public/%2D%2D-dgreports/%2D%2D-dcomm/%2D%2D-publ/documents/publication/wcms_633135.pdf (Accessed on 14 December 2019).

Jarrett, T. 2019. *Adult social care: the Government’s ongoing policy review and anticipated Green Paper (England)*, House of Commons Library Briefing paper 8002. https://commonslibrary.parliament.uk/research-briefings/cbp-8002/#fullreport. (Accessed 15 May 2020).
Jones, O. 2020. *Coronavirus has exposed the extent of the UK’s social crisis* https://www.theguardian.com/commentisfree/2020/mar/18/coronavirus-exposed-extent-uk-social-crisis (Accessed on 2 May 2020).

Kitzmiller, R., McDaniel, R., Johnson, C., Lind, A. and Anderson, R. 2013. Exploring interpersonal behavior and team sensemaking during health information technology implementation. *Leading in Health Care Organizations: Improving Safety, Satisfaction and Financial Performance Advances in Health Care Management*, 14(1), pp. 119–144.

Koppel, R., Metlay, J. P., Cohen, A., Abaluck, B., Localio, A. R., Kimmel, S. E., and Strom, B. L. 2005. Role of computerized physician order entry systems in facilitating medication errors. *The Journal of the American Medical Association*, 293(10), 1197–1203.

Kuenssberg, L. 2020. *Coronavirus: Social care concerns revealed in leaked letter* https://www.bbc.co.uk/news/uk-politics-52304918 (Accessed on 2 May 2020).

Macdonald, M. 2020. *The health and social care workforce gap* https://commonslibrary.parliament.uk/social-policy/health/the-health-and-social-care-workforce-gap/. (Accessed on 2 May 2020).

Maiden, N., D’Souza, S., Jones, S., Müller, Pannese, L., Pitts, K., Prilla, M., Pudney, K., Rose, M., Turner, I. and Zachos, K. 2013. Computing Technologies for Reflective, Creative Care of People with Dementia. *Communications of the ACM*, 56(11).

Meskó, B., Hetényi, G. and Győrffy, Z. 2018. Will artificial intelligence solve the human resource crisis in healthcare? *BMC Health Services Research*, 18(545).

Mohammed, A., White, G., Wang, X. and Kai Chan, H. 2018. IT adoption in social care: A study of the factors that mediate technology adoption. *Strategic Change*, 27(3), pp. 267–279.

NHS, 2019. *The NHS Long Term Plan*. https://www.longtermplan.nhs.uk/publication/nhs-long-term-plan/ (Accessed on 15 May 2020).

NHSX n.d.-a. *About us* https://www.nhsx.nhs.uk/about-us/ (Accessed on 1 May 2020).

NHSX n.d.-b. *COVID-19 Response*. https://www.nhsx.nhs.uk/covid-19-response/ (Accessed on 14 May 2020)

Pickard, L. 2008. *Informal Care for Older People Provided by Their Adult Children: Projections of Supply and Demand to 2041*. Personal Social Services Research Unit (PSSRU), London, UK. Discussion paper 2515.
Ramadevi, D., Gunasekaran, A., Roy, M., Rai, B. and Senthilkumar, S. 2016. Human resource management in a healthcare environment: framework and case study. *Industrial and Commercial Training*, 48(8), pp. 387–393.

Saborowski, M. and Kollak, I. 2015. How do you care for technology?—Care professionals’ experiences with assistive technology in care of the elderly. *Technological Forecasting & Social Change*, 93, pp. 133–140.

Stewart, A. and MacIntyre, G. 2013. Care management in the twenty-first century: Persistent challenges in implementation in the context of the emergence of self-care. *Journal of Integrated Care*, 21(2), pp. 91–104.

The care workers charity, 2019. *The essential careworkers guide* https://www.thecareworkerscharity.org.uk/carers (Accessed on 26 January 2020).

United Nations Economic Commission for Europe, 2019. *Policy brief: The challenging roles of informal carers*. https://www.unece.org/fileadmin/DAM/pau/age/Policy_briefs/ECE_WG1_31.pdf (Accessed on 14 December 2019).

Wright, J. 2019. Robots vs migrants? Reconfiguring the future of Japanese institutional eldercare, *Critical Asian Studies*, 51(3), pp. 331–354.

World Health Organisation. 2016. Health workforce requirements for universal health coverage and the Sustainable Development Goals Human Resources for Health Observer - Issue No. 17. Available at: https://www.who.int/hrh/resources/health-observer17/en/.

Yeandle, S., Chou, Y., Fine, M., Larkin, M. and Milne, A. 2017. Care and caring: interdisciplinary perspectives on a societal issue of global significance. *International Journal of Care and Caring*, 1(1), pp. 3–25.