Power, paradox and pessimism: on the unintended consequences of digital health technologies in primary care

Introduction

There are ample opportunities to observe that things do not always turn out as expected. Unintended consequences '*which result from behaviour initiated for other purposes'* (Giddens 1993, p.765) have provided rich pickings for social scientists since Robert Merton described these phenomena in 1936 (Merton, 1936). Examples include the tendency for performance management to bring unwelcome corollaries such as bureaucratisation and tunnel vision. Despite generally virtuous intentions, public health policies may also result in unforeseen negatives, such as increased injuries when physical activity initiatives promote cycling to school (Oliver et al., 2019). Bonell and colleagues (2015) have argued that there is an ethical imperative to pre-hypothesise, at the planning stage, potentially harmful unintended consequences of public health interventions, as well as their underpinning mechanisms, referring to this as 'dark logic'. In complex health care systems where components interact in '*nonlinear, dynamic, and unpredictable ways'* (Lipsitz, 2012, p.1), unintended consequences are likely to attend new initiatives. Primary care in the UK has numerous examples of attempts to shift practice to embrace 'digital solutions' against an undeniably complex backdrop. Our aim is to consider what might be learned from unintended, apparently unanticipated, consequences (for people, relationships, organisations and ways of working) of the use of digital health technologies in primary care and how this understanding might be applied to illuminate and inform future implementation.

De Zwart (2015) reminds us that 'unintended' and 'unanticipated' are not synonyms: consequences can be anticipated and either intended or unintended, but it is clearly impossible for an *unanticipated* effect to be intended. While the literature in this field has often been primarily concerned with unhappy surprises, not all consequences that are (broadly speaking) *unexpected* are necessarily unwelcome.

Public sector reformers may sometimes seem naïve when the consequences of their actions appear unanticipated, but as Peters (2007) points out, policy makers are often faced with a need to *'make difficult choices in complex situations'* (p.23). Contemporary readers are unlikely to need reminding that the COVID-19 pandemic has challenged policy makers trying to protect health systems, workforces and economies while allowing health facilities, schools, workplaces and public spaces to stay open.

In the relatively new field of digital health, Lupton (2014) and others have noted the dominant 'techno-utopian' position on digital 'solutions' adopted by many supporters, calling for a more critical stance to be taken. A chorus of social scientists (e.g. Ash, 2004; Coiera, 2016) have argued that digital health focusses too much on the technology, contending that complexity is routinely overlooked and that interventions that do not learn from complex adaptive approaches are unlikely to succeed (Greenhalgh & Papoutsi, 2018).

Science and Technology Studies (STS) draws on social constructivism to offer a more critical stance to the study of digital health that invites social as well as technical analysis (Bijker et al., 2012). Technologies hold different meanings in different contexts and are used in diverse ways, for different purposes. Thus *'any "failure" of technologies should be located in the socio-technical relations of usage, especially in the expectations, skills and resources of human users'* (Gooday, 1998, p.265). Woodhouse and Patton (2004, pp.2-3) observed that *'what "makes sense" will tend to be in accord with designers' tacit assumptions'* which may *'depart in significant ways from those of the unrepresented'*. Using the example of city streets, they consider how different these would be if traffic engineers and urban designers were disproportionately comprised of wheelchair-users, elderly people, cyclists or those with visual impairments. Attempts at heterogeneous engineering have emphasised the breadth of people, existing technologies, processes, regulations or values with which a technology must co-exist in order to 'succeed' (Law, 1987). STS scholars see technology implementation, as a '*highly complex, heterogeneous, and vulnerable process'* (Ertner, 2019, p.34), shedding light on the 'invisible work' that is required. Oudshoorn (2008) for example, revealed a multitude of vital articulation, affective and inclusion work required from patients and physicians to operate new tele-

monitoring applications. Examining the introduction of webcams in a rehabilitation clinic, Pols and Willems (2011) described processes of 'tinkering' where the technology needed to be 'tamed' to adapt to the practice of users while also affecting care practice and creating 'new kinds of controversies' (p.35). The messy and heterogenous aspects of technology-implementation are often side-lined within mainstream innovation discourses.

In many high income countries, including the UK, digital approaches to health care have been championed by enthusiastic policy makers as offering the potential to address some of the key 21st century challenges by providing cheaper, safer care that is more accessible to patients and at least as effective and patient-centred as the traditional alternatives (NHS, 2019). Particularly in the area of primary care, digital access to services (encompassing remote consultations, remote monitoring and self-management) and digital administrative systems (for patients to manage appointments, order prescriptions and access their electronic health record and test results) have been seized upon as answers to what is often described as the 'crisis' in primary care (Blackwood, 2019). In the UK, this crisis is characterised by an ever worsening shortage of GPs, associated structural changes which have moved away from a model of continuity of care with a single practitioner, growing need for care from a population living longer with more complex and chronic health problems, a shift to shorter hospital stays and continued lack of resource in social care services (Buchan et al., 2019). The coronavirus global pandemic has exacerbated this crisis, as well as provided a sudden impetus towards digital services (Peek et al., 2020).

In this paper our focus is on digital health technologies defined as '*technologies which use computing platforms, connectivity, software, and sensors for health care and related uses'* (FDA, 2020). The rapid increase in the use of these tools in primary care provides a timely opportunity to consider unintended consequences and their underlying mechanisms. Our intention here is not to rehearse the strengths and weaknesses of different types of digital health technologies (see e.g. Atherton and Ziebland, 2016 for a review), nor to document the harms that digital health tools can lead to (occasionally referred to as e-iatrogenesis) (Weiner, 2007). Instead, we have conducted a conceptual review, which is reported in an essay format (anon for review 2012), rather than as a conventional literature synthesis. Our main aim was to

develop a higher order understanding of the more nuanced patterning of unintended consequences of digital health technologies in primary care, which are rarely simply positive or negative.

Methods

As a conceptual review, this article takes an essay format rather than a conventional literature review or meta-synthesis reporting structure. Oliver et al. (2019) point out that the unintended consequences of interventions are rarely evaluated or reported systematically. We therefore recognised that, for the purposes of this review, the material that was of most interest to us might be raised in the discussion rather than reported in the findings. Here we describe the methods that we used to identify papers, and how we identified and extracted key points to inform this essay.

Clarification of Scope

To clarify our scope, we set the review question as: "what are the unintended consequences of digital health interventions and technologies in primary care?" A range of research designs - qualitative studies, surveys and trials – were included.

Search for Evidence

We began by carrying out a formal literature search with assistance from a Senior Health Care Librarian. This formed one element of exploring the literature and informing this essay. Digital health is a fast-moving field, we therefore took as a starting point UK and international studies published from 2014 onwards which examined the introduction of any digital technology in a primary care setting, involving the care of patients by primary care staff. This includes the use of online systems for making appointments, alternatives (such as email, video calls) to the face-to-face consultation, patient access to electronic health records and mobile apps to support monitoring and self-care. As well as studies of any research design, we also included editorials, opinion pieces, and critiques of policy initiatives. To identify these initial sources, a range of search techniques - including subject headings, keywords and exact phrases - were applied to four databases (Medline, Embase, Web of Science, and PsycINFO). Search terms for digital health technologies (including terms and headings related to computers, telemedicine, telecare, telehealth, remote

consultations, videoconferencing, self-care or self-management, electronic health or medical records, mobile health, mobile devices, apps, internet health, digital platforms, online tools, social media, and others) were combined with terms and headings for primary care (primary health care, general practice, family practice and general practitioners as subject headings, and variations of these as search terms). As the focus of our work was on high income countries, a filter was used to exclude low income (developing country) settings. A filter for 'consequences' was also applied (e.g. 'intended', 'unintended' etc.), but we also included results without this explicit phrasing. After scanning the resulting titles and abstracts, we coded references according to their relevance and potential for inclusion, and subsequently refined our search terms. The literature included in our formal search reflects an era when health care providers have been attempting to harness digital technologies to address health needs in new and novel ways (Anon for review 2015). We therefore excluded studies of technologies that are part of current standard care (e.g. telephone consultations) or technologies without direct involvement in patient care (e.g. studies on administration systems). Having refined our inclusion criteria, a second search with the Librarian retrieved a total of 3,292 texts from the social and health sciences (both UK-based and international). We organised the literature by source-type (studies, systematic reviews, conference abstracts, protocols, books, and dissertations), and by UK or non-UK context. Though the sources in our bibliographic database included a vast range of digital technologies, broadly they shared the aim of assessing or evaluating a general or specific outcome of digital health tools in primary care.
We supplemented our understanding by reading key articles identified through snowballing via citations (some of which were published before the 2014 cut-off for our formal search), and through inter-disciplinary discussions and seminars with colleagues. It was often through this informal process that we identified the most valuable literature; for example, exploring how Science and Technology Studies could enhance our critical understanding of technology implementation. Our literature search was both iterative and collaborative, developing as we refined our reading and the narrative of this article.

Extracting & Synthesising the Unintended consequences

Through in-depth reading and interpretation of the literature we identified and extracted all descriptions of unintended consequences from the published accounts.

A limitation of this approach is that those developing or implementing a digital technology might not draw attention to 'unintended' outcomes, especially if these are negative. Very few articles examined unintended consequences in relation to specific tools. Our extraction criteria were modified as the study progressed. Where unintended consequences were suggested, we organised these thematically, breaking them down into 'headline' themes already well covered in the literature, and 'nuanced' themes that were less explored. During our reading, it became clear that unintended consequences in this context were not straightforwardly either 'positive' or 'negative'. To capture this complexity and refine our extraction process, we developed a coding framework in which unintended consequences were coded in relation to their effects, context and longevity. We also found consequences that were the polar opposite of those intended and others that were likely generic to any attempts at organisational change (whether or not the change was digital).
This process was central for deciding on inclusion; we also remained open to new literature and kept our search active in these final stages. A constant comparison approach between the working table and all subsequent reading identified the point at which we had reached data 'saturation' (Glaser, 1965). Formal quality appraisal tools are not used for conceptual reviews however all papers were read in full and considered in relation to the inclusion and exclusion criteria, relevance and rigour (Anon 2012). We discussed key emerging issues with our wider team of collaborators, all of whom work in primary care and digital health research.

Findings

We present three higher order themes to support better understanding of the underpinning mechanisms for unintended consequences in digital health technologies in primary care. These themes are illustrated by case examples, with focus on those that have been little discussed in the literature. Following Merton's (1936) differentiation between consequences for the actor(s) and others, which are mediated through the culture and social structure, we discuss consequences that i) disrupt power relations between patients and health professionals or between different groups of health professions, ii) contribute to paradoxical outcomes and iii) result in a potentially corrosive sub-culture of pessimism about digital health. While our focus is on primary care, we return to the wider sociological literature in the final discussion section.

Power: disrupted relations

Digital health technologies are often framed as 'disruptive innovations' (Christensen et al., 2009). Meskó et al. (2019, p.2) view digital health as '*the cultural transformation of how disruptive technologies that provide digital and objective data accessible to both caregivers and patients lead to an equal level doctor-patient relationship with shared decision-making and the democratization of care'*. Here, 'disruptive' technologies fundamentally reconfigure the patient-doctor relationship and have consequences for power relations. When knowledge that was once held in the elite domain of medicine became accessible to anyone with an internet connection the phenomenon of the 'e-patient' emerged with an empowered, active role in their care through digital technology (Meskó et al., 2019). Likewise, (Anon for review 2016) coined the term 'digital health citizen' for those who, gaining the tools and opportunities needed to actively engage in their health care, are also required to take on new responsibilities. There are consequences for relationships in front-line care, particularly with general practitioners (GPs) (Kim and Kim, 2009; McMullan, 2006; Tonsaker et al., 2014). A study in Ireland demonstrated this in the case of self-management technologies (Morrissey et al., 2018). GPs reported a shift in power dynamics when patients drew on their knowledge to adopt the more 'senior' role in consultations by presenting and explaining an app to their GP (Morrissey et al., 2018). Using conversation analysis Stevenson et al (2019) demonstrate how asymmetrical power relations are maintained in the consultation when internet resources are 'recaptured' by the GPs.

Inter-professional power dynamics may also be disrupted by digital technologies. In Israel, Chudner et al. (2020) found that primary care physicians believed video-consultations further perpetuated their low relative power in relation to the executive managers responsible for decision-making in the Israeli primary care setting. Physicians felt their organisation assimilated technologies that pleased the patient, regardless of their opinion. Some believed video consultations fostered a 'big brother' culture, one commenting: *'Because it's computerised, in addition to knowing exactly what my quality measures are and what I am supposed to improve, now it will give them more options to follow after me'* (2020, p.10).

A persistent concern has been that easier digital access could increase demand from patients, leading to 'over consumption' and a spiral of increased expectations. Topol (2015) writing in the US, suggested that digitalisation would upset the power balance between doctors and patients leading to increased pressure for treatment. He noted that this might lead to improvements to quality if patients have the option to 'shop around' for treatment. Evidence that demand and consumption has increased due to digital options is scant but there are some indications that primary health care providers may be more likely to issue a prescription during a remote consultation. Unsurprisingly, the few studies that have reported in this field focus on antibiotic prescriptions. While the evidence is scarce, this concern about over-prescribing, especially in relation to antimicrobial stewardship, is potentially one of the more serious of the unintended consequences of digital health technologies in primary care and deserves attention.

A US study provides some evidence that primary care doctors are more likely to prescribe antibiotics during a remote 'e-visit' than during a face-to-face consultation for sinusitis or a urinary tract infection (Mehrotra, 2013). A 2018 study of seven private online video consulting companies operating in the UK found that four of the online services specified on their websites that they would prescribe antibiotics (Peters et al., 2018). The authors noted that none explained the difference between viral and bacterial infections nor mentioned the need for antimicrobial stewardship. Indeed, the relative ease of access to treatment with antibiotics was used as an advertising strategy for these online services. Internet searches for 'get antibiotics', 'prescribe antibiotics', 'antibiotic prescription', 'buy antibiotics' and 'private antibiotics' all provided an advertising link to a general practice video consultation service promising an antibiotic prescription 'in minutes' as the top result (2018, p.163). The drivers for this behaviour include the wish to 'play it safe', the suspicion that the patient will 'shop around' online, uncertainty around the medico-legal consequences of online prescribing, reluctance to embark on time-consuming and interactionally complex explanations about why a prescription may not be needed, or concern about potential damage to the doctor's online ratings if they do not acquiesce to a request.

Interestingly, in Sweden, which prides itself on a comparatively low rate of antibiotic prescribing through its (public funded) healthcare system, the belief that online doctors would overprescribe was one of the three main concerns expressed about telemedicine (the others were that the physical exam is necessary for diagnosis and that telemedicine would encourage consultation for trivial complaints). Although allegations that online services in Sweden were overprescribing antibiotics have been challenged on methodological grounds, the concern led to an increase in regulation and oversight of prescribing through online services (Blix and Jeansson, 2018) with the authors concluding that '*it is the remuneration systems and supervision that should be reformed, not the patients' demand for better health care'* (2018, p.21).

Digital health technologies pose new issues of accountability and documentation with consequences for power relations (Dudhwala and Woolgar, 2019). In Norway, Melby and Hellesø (2014) identified the unintended consequences for inter-professional collaboration of e-messaging. As e-messages appeared automatically in patients' electronic record, homecare nurses felt their requests to GPs to call back now carried more weight than when mediated through GPs' medical secretaries with sticky note reminders that frequently got 'lost'. The authors concluded that the '*structural change in communication had the unintended consequence of challenging the established status between nurses and GPs'* (Melby and Hellesø, 2014, p.351).

Digital technologies may also unexpectedly help to balance power relations between patients and GPs making it easier to address issues that matter to the patient. Recent qualitative interviews about GP's safeguarding practices during the pandemic found that, although there were several ways (such as concerns about the patients' privacy, inability to assess body language, lack of continuity) in which remote consultations made it more difficult for the GPs to raise safeguarding issues, there were also new opportunities, such as less pressured discussions when neither the patient nor the GP was conscious of a full waiting room or an over-running clinic (Anon, 2021). In Canada, Ferrari et al. (2016) explored perspectives surrounding a tablet-based survey completed by patients in the GP waiting room. iCCAS (Interactive Computer-Assisted Client Assessment Survey) involved a mental health self-assessment with impact on access and care provision evaluated among providers

and immigrant, refugee ethnic minority and low-income groups. While the intended purpose of iCCAS was to generate a risk-summary for clinicians and a plain-language recommendation sheet for patients, in practice the intervention also provided some patients with '*tangible proof of their distress and mental health issues'* and gave patients '*permission to speak'* about the issues in the consultation (Ferrari et al., 2016, p.9).

In Banks et al's. (2018) study of asynchronous written online consultations, practice staff sometimes characterised patients as 'gaming' the appointments system to achieve quicker access (e.g. by selecting the 'blood test' option when they needed a face to face appointment rather than trying to justify their need via algorithmic tick boxes). While patients might more generously be seen as finding workarounds rather than 'gaming', staff characterised this as an inappropriate use, particularly when the responsibility (to arrange access) shifted back to the practice (2018, p.5).

The double-edged sword of the 'digital health citizen' has received less attention in recent years. In 2003 sociologist Henwood (2003, p.605), argued that '*the informed patient will not emerge naturally or easily within existing structures and relationships'*. Fifteen years later Morrissey et al's. (2018) exploration of smartphone apps, noted tensions around inconsistent divisions of responsibility which differed by technology type. For example, GPs were happy to encourage digital reminders to take medicines, where the responsibility for the action lay with the patient. However, when home blood pressure monitor readings were sent directly to the GP these were less popular. GPs concerns included that technology amplified the fuzziness of boundaries around the duty of care (Morrissey et al., 2018). Such unresolved tensions and inconsistencies can lead to confusion around patients' rights and responsibilities as 'digital health citizens'.

We now turn to paradoxical consequences, those that are not just disruptive, but appear to be in stark contradiction to the intention.

Paradoxes

By paradoxical consequences we mean those effects which are the opposite of those intended. This is not simply a category for the harmful effects of tools intended to bring benefit, of which there are plenty of examples in the healthcare technology literature, but is more specific, addressing the irony of how a tool designed for a particular purpose can deliver a contrary outcome, sometimes in parallel. In 1983 Bainbridge drew attention to the 'ironies of automation' which show that as technologies become more advanced people with specialised skill sets are needed on hand for the occasions when the technology fails. Paradoxical tensions have been observed in the information technology (IT) field for decades (Ciriello et al., 2019), for example how IT can both grow and constrain productivity (Brynjolfsson, 1993). Examples from health include dualities in how remote caring technologies can both empower and disempower caregivers and the people they care for (Anon for review 2010), and how social media can be socially isolating (Primack et al., 2017). In a seminal early work in the field of digital health, Koppel and colleagues identified how a hospital-based computerized physician order entry system designed to reduce medication errors led to 22 types of medication error risks (Koppel et al., 2005). A systematic review of technology interventions to improve medication safety in primary care also noted the potential for e-iatrogenesis (Lainer et al., 2013).

We identified several studies which illustrate paradoxical consequences of primary care digital technologies. We focus on examples from three areas: tools designed to manage workload which increase it, safety initiatives which lead to errors, and innovative communications which worsen interactions. In a UK primary care setting, Banks and colleagues (2018) showed that an e-consultation system introduced in part to help reduce workload was perceived as adding to overall GP workload due to the need for frequent additional follow-up telephone or face-to-face consultations in order to get full information for clinical decision-making. The authors concluded that the system did not deliver financial savings and there was no overall improvement in freeing up GP time (the intended effect of the innovation). In practice this e-consultation system, designed to replace some offline interactions, was used for making triage decisions rather than clinical ones. In Sweden Öberg and colleagues (2018, p.964) interviewed primary care nurses who also reported the unintended increase in workload caused by the digitalisation of primary care. They described 'digital chaos' and delay caused by multiple logins on unsynchronised systems for

which they neither had time nor training. Digitalisation of primary care was perceived by the nurses as a threat to the nurse/patient relationship due to the loss of personal contact, worries that this might compromise safety, and a feeling that they were spending too much time on digital administrative tasks.

Sociotechnical studies have long recognised that innovations require changes to working practices and affect inter-professional relationships. This can lead to active resistance, passive hindrance or resistive compliance, especially if the benefit is not immediately apparent. Technologies can lead to paradoxical effects in one setting and not in others, and often issues of local implementation are key. We found instances of primary care initiatives designed to reduce errors, which had the effect of increasing them, often these related to electronic health record and clinical decision support systems. Sittig and colleagues (2016) review the 'new' unintended consequences of electronic health records. These include interoperability challenges which mean that clinicians often have incomplete information available to them to inform decision-making; and conversely the risks presented by '*information overload from marginally useful computer-generated data'* (a combination of data from decision support systems, text generated from clinician-entered structured data, and a tendency to freely 'cut and paste' in electronic records) and how they can – ironically – lead to clinicians missing information which leads to harm (2016, pp.7, 10). The authors also report the risks of frustrating user experiences causing user errors due to poor design and regulatory constraints; privacy and confidentiality breaches; and a focus by clinicians on recording measures used by systems for performance management distracting from potentially more important outcomes.

A third area where we found paradox was where new communication systems were found to impair communication. For example, Donaghy and colleagues (2019), studied video consultations in UK primary care. While noting that these offer advantages over telephone appointments, and had advantages for certain groups (such as working patients, or those with mobility problems), they also describe how technical and reliability problems were common. These technical challenges reduced the rapport and the effectiveness of communication. A participant in a study of online consultations by Farr and colleagues (2018, p.7), felt their treatment had been

"compromised and delayed as a result' of a technology that was meant to improve health care access and efficiency.

In the literature describing unanticipated consequences of digital health technologies, it is striking to note the number of accounts of tools designed to be safer or more effective or cheaper or more patient-centred (all claims which are frequently made for digital tools) which have effects which show them to be less safe, less effective, more expensive or disempowering. This may be influenced by the nature of rhetoric and the compelling narrative of a paradoxical tale of the unexpected; accounts suggesting hubris are thus more likely to attract attention. Such reports may also contribute to a more pervasive culture of scepticism about all things digital, which is the unintended consequence we turn to next.

Pessimism: a potentially corrosive sub-culture

Resistance to change is normal, and innovation fatigue may be anticipated in systems that are constantly changing (Greenhalgh et al., 2008), so here we consider whether there is any evidence that negative experiences of digital health technologies in primary care may contribute to a sceptical narrative about digital initiatives *in general*. This of course is in striking contrast to the generally optimistic, and sometimes techno-utopian, tone of much of the policy statements in this area (Henwood 2019). There is a narrative among health care staff about 'the burden of technology' whereby technology is seen as 'cumbersome' or causing interference with clinician-patient relationships. For example, in comparison with other forms of 'warm' caring work, Mol et al. (2010) characterised work involving technology as 'cold'. Similarly, Öberg et al. (2018) reported that in their study Swedish nurses were convinced that the patient was the 'biggest loser' in an increasingly digitised healthcare system that makes health care more impersonal. Chudner and colleagues (2020) reported that Israeli doctors believed that their own needs were seen as less important than those of patients, leading to a broader resistance to telemedicine. This reduced their intention to use video-consultations, linked to feelings of powerlessness and lack of control in the implementation plans for digital health technologies (2020, p.5). Reflecting on recent changes that have encouraged others to leave the profession, British GP Helen Salisbury has recently written:

So, what would it take to make me throw in the towel? If the only way of seeing patients in future was through remote consulting, I wouldn't last. Many doctors have adapted to this new way of working, but I'm not one of them. And if I lost continuity of care and was unable to look after my own list of patients, I'd struggle to enjoy the job. (Salisbury 2021)

In outlining the ISTA (interactive sociotechnical analysis) model for understanding organisational consequences of digital health technologies, Harrison et al. (2007) excluded the response of 'negative emotions' on the grounds that these operate at an individual level. However, we propose that in the culture of primary care practice negative experiences of digital health technologies may have a corrosive effect, contributing to a shared narrative of failure, poor value for money, suspect or discredited rationale and compromised safety. This is partly due to the perception (or perhaps observation) that different digital health technologies nevertheless share features (e.g. imposed, remote, cold, impersonal) that explain their failure or non-adoption in primary care settings. As presented in our exploration of disrupted power relations and paradoxical outcomes, digital technologies have been blamed for creating more work, undermining communications, misrepresenting complex workflows as linear, causing new types of errors, creating over dependence on technologies, damaging existing structures and patterns of work, causing staff frustration with inflexible systems, and compromising patient safety (see for example Atherton and Ziebland, 2016). Staff often respond to these features with workarounds to avoid cumbersome procedures, accommodations which (as we have discussed above) are portrayed as 'gaming' when exercised by patients. Health professionals who have not been fully engaged in the adoption of the new technology may enact 'resistive compliance' (Hans, 2018) whereby they minimise interaction with the new technology without openly rejecting its use.

Individuals may also draw on their experience of negative consequences of digital health technologies to construct a shared narrative that these 'types' of changes do not work. Johansson et al. (2014, p.175) found that nurses expressed an aversion to working with new technology contending that *'the more technology…the more sources of error'*. Patients weigh up perceived benefits of accessing their own health records against security and other risks, for example hacking, unauthorised access

and identity theft. Accounts of failed and expensive IT systems appear to seep into a collective scepticism among some staff in primary care about 'new systems' especially those for handling large databases. As a participant in Papoutsi et al.'s (2015) study commented '*I just have very little faith in the way that the NHS handles databases. I don't think it's got a very good record. […] I know how bad some of the IT systems have been. I've had to work with them myself, and we just hope the National Health Service will get this one right. They've got a few wrong in the past…'* (p.10).

Members of the public may also worry that insurance companies, employers and *'people outside the NHS'* could gain access to their records (Papoutsi et al., 2015, p.8). Any overarching scepticism about competence and security could jeopardise the adoption of digital technologies in primary care, even those that pose no apparent security risk. Innovators who make it their business to ask staff about their past experiences with digital technology will be in a better position to engage fruitfully with any concerns. And of course, those staff whose experience of digital health technologies in primary care is largely positive (perhaps due to being appropriately consulted, involved and trained) will be likely to receive other new ideas more enthusiastically.

Discussion

In this essay, based on a conceptual review of digital health technologies in primary care, we have tried to move beyond an approach which characterises the 'barriers and facilitators' to the adoption of technologies, or their 'strengths and limitations'. Typically, when a technology is introduced (whether through a trial, or into routine practice) there will be enthusiasts as well as cynics. If the rationale for staff (or patient) resistance is not understood, evaluators are in danger of concluding that the technology would surely succeed if only the errant staff (or patients) were better trained or re-educated. While this 'knowledge deficit' model of behaviour change has been widely discredited for patients and the public, it remains strangely persistent in relation to health care professionals.

We agree with Henwood and Marent (2019) that the dominant health policy discourse is promissory, and often uncritically positive in tone, yet, as we have

shown, this is not entirely shared by primary care staff who have had exposure to digital health technologies in their organisations. The need to pivot to remote consultations during the 2020/21 pandemic has given GPs and the communities they serve opportunity to reflect on what is gained and what is lost. These newly informed perspectives need to be used to help reconfigure access and consultations; if they are not it is likely that the crisis in recruitment and retention in primary care will continue.

Nevertheless, primary care can gain from embracing the opportunities offered by digital health technologies. Professionals may be pleasantly surprised to learn, from sociological research, that supportive relationships with healthcare professionals can develop through texting related to remote monitoring for diabetes (Piras 2019) or that some 'high tech' wearable technologies can be associated with more comfortable and 'natural' feeling care, as evidenced by Joyce (2019) in relation to remote (non-tethered) monitors for use in childbirth and with new-borns.

Whether or not an unintended consequence is considered desirable often depends on whose perspective is considered, for example who becomes 'empowered' at whose expense and with what results. Utopian visions of patient 'empowerment' have been critiqued in recognition of the constraints and contradictions that are bound within existing structures and relationships. Clearly, in relation to power relations more nuanced understandings of 'positive' or 'negative' unintended consequences are needed.

Unexpected effects may be thought almost inevitable with any drive to modernise, especially with technology (Margetts et al., 2012). Lipsitz points out that in a complex and non-linear system such as health we should expect the unexpected (Lipsitz 2012). However, Perri 6 (2014) questions whether unintended consequences really are an inevitable feature of public policy. Using a neo-Durkheimian lens to assess the individual and structural agency associated with an array of (welcome and unwelcome) unintended consequences from three British governments of the 1960s and 1970s. Perri 6 argues that at least fifteen years' hindsight, documents, data and reflection from the actors are required to consider fully the consequence of policies. The author draws on the exemplar of Edward Heath's conservative government in

the early 1970s: '*Heath's great achievement of securing EEC membership in 1972 has enraged Europhobes in Britain ever since, but its intended consequences dominated its unintended ones'* (2014, p.688). Writing in 2021, as Britain leaves the EU, it is apparent that an even longer long view may sometimes be required. We are sure this will also be the case as researchers and policy makers try to unravel the effects of different governments' responses to the Covid-19 pandemic on health, education, trust in experts, employment, the economy, transport, tourism, inter-generational and social relationships.

Perri 6's analysis of models of decision making and implementation also suggests that the distribution of intended and unintended consequences is far from random. Applying these observations to digital health technologies in primary care, we may concur that organisations based on an individualistic model are inclined to be over-optimistic about their ability to introduce change (Perri 6). The emergence of ways to 'game' a system (whether by staff or public) are typically associated with changes imposed through hierarchy. These can be just as disruptive, even if less apparent, as an 'open revolt' response, which is more often associated with changes imposed through constraint (Perri 6). Policy makers and practitioners will not be able to prepare or control for every unexpected eventuality, yet awareness of both the complex adaptive nature of primary care and the roles both of actors and system structure are key.

We propose that when evaluating or implementing digital technologies in primary care, careful consideration should be given to the 'dark logic' of the technology (Bonell et al., 2015) in context, as well as to its potential. We agree with Bonell and colleagues that when evaluators or implementers consider the intended benefits of their intervention (through a logic model), they should also systematically consider what the unintended effects may be, through theorising these through consideration of interactions with stakeholders and social structures, by comparing the consequences of similar tools where an evidence base exists, and by consulting individuals or groups familiar with the local context. In particular, attention to the issues that we have discussed in this article, of disrupted power relations, the potential for paradoxical outcomes, and impacts on the expectations of staff in relation to digital innovation are advisable, and reduce the likelihood of these being

unanticipated. In this way a more critical, nuanced, and realistic assessment of the likely impact of the innovation (and associated practices and processes) can be made, and staff can be vigilant to the early indications of negative consequences. Wider discussion with the workforce, as well as with patients and the public, before implementation could help to avoid unintended negative effects and help avoid a corrosive pessimism among staff about digital technologies. Such an approach could also help to foster a sense of ownership, interest in monitoring the effects that matter to the organisation and renewed interest in deploying digital innovations that show promise. Accounts of unintended consequences make engaging stories; a reflective, learning organisation could employ these examples as part of an implementation strategy to raise awareness of such effects and challenge the more techno-utopian visions of the digital enthusiast policymakers, while still supporting change and quality improvement among (the generally more sceptical) staff by demonstrating an awareness to be vigilant to, and learn from, unintended effects.

References

6, P. (2014). Explaining Unintended and Unexpected Consequences of Policy Decisions: Comparing Three British Governments. *Public Administration*, *92*(3), 673-691. doi: 10.1111/padm.12081

Ash, J., Berg, M., & Coiera, E. (2004). Some Unintended Consequences of Information Technology in Health Care: The Nature of Patient Care Information System-related Errors. *Journal Of The American Medical Informatics Association*, *11*(2), 104-112. doi: 10.1197/jamia.m1471

Atherton, H., & Ziebland, S. (2016). What do we need to consider when planning, implementing and researching the use of alternatives to face-to-face consultations in primary healthcare?. *DIGITAL HEALTH*, *2*, 205520761667555. doi: 10.1177/2055207616675559

Bainbridge, L. (1983). Ironies of automation. *Automatica*, *19*(6), 775-779. doi: 10.1016/0005-1098(83)90046-8

Banks, J., Farr, M., Salisbury, C., Bernard, E., Northstone, K., Edwards, H., & Horwood, J. (2018). Use of an electronic consultation system in primary care: a qualitative interview study. *British Journal Of General Practice*, *68*(666), e1-e8. doi: 10.3399/bjgp17x693509

Bijker, W., Hughes, T., Pinch, T. and Douglas, D. (2012). *The social construction of technological systems*. Cambridge, Mass.: MIT Press.

Blackwood (Baroness), N. (2019). *Building a digitally enabled NHS*. Speech, Delving into Digital: Association of Medical Research Charities. Retrieved from https://www.gov.uk/government/speeches/building-a-digitally-enabled-nhs

Blix, M., & Jeansson, J. (2018). *Telemedicine and the welfare state: The Swedish experience, IFN Working Paper, No. 1238*. Stockholm: Research Institute of Industrial Economics (IFN). Retrieved from https://www.econstor.eu/bitstream/10419/183467/1/wp1238.pdf

Bonell, C., Jamal, F., Melendez-Torres, G., & Cummins, S. (2015). 'Dark logic': theorising the harmful consequences of public health interventions. *Journal Of Epidemiology And Community Health*, *69*(1), 95-98. doi: 10.1136/jech-2014-204671

Brynjolfsson, E. (1993). The productivity paradox of information technology. *Communications Of The ACM*, *36*(12), 66-77. doi: 10.1145/163298.163309

Buchan, J., Charlesworth, A., Gershlick, B., & Seccombe, I. (2019). *A critical moment: NHS staffing trends, retention and attrition*. The Health Foundation. Retrieved from https://www.health.org.uk/sites/default/files/upload/publications/2019/A%20Critical%20Moment_1.pdf

Christensen, C., Grossman, J. and Hwang, J. (2009). *The innovator's prescription*. New York: McGraw-Hill.

Chudner, I., Drach-Zahavy, A., Goldblatt, H., Goldfracht, M., & Karkabi, K. (2020). Power Gaps Among Stakeholders in Israel's Primary Care and the Role of Primary Care Physicians' Relative Power in Their Intention to Use Video-Consultations with Patients. *Telemedicine And E-Health*, *26*(2), 190-204. doi: 10.1089/tmj.2018.0288

Ciriello, R., Richter, A., & Schwabe, G. (2019). The paradoxical effects of digital artefacts on innovation practices. *European Journal Of Information Systems*, *28*(2), 149-172. doi: 10.1080/0960085x.2018.1524418

Coiera, E., Ash, J., Berg, M. (2016). The Unintended Consequences of Health Information Technology Revisited. *Yearbook Of Medical Informatics*, *25*(1), 163-169. doi: 10.15265/iy-2016-014

Dafoe, A. (2015). On Technological Determinism: A Typology, Scope Conditions, and a Mechanism. *Science, Technology, & Human Values*, *40*(6), 1047-1076. doi: 10.1177/0162243915579283

de Zwart, F. (2015). Unintended but not unanticipated consequences. *Theory And Society*, *44*(3), 283-297. Retrieved from https://www.jstor.org/stable/43694760

Dixon S, Frost L, Hawcroft C, Cox R, Feder G, Ziebland S. Understanding GP perspectives on managing safeguarding in primary care via remote consulting as necessitated by the COVID-19 pandemic. South West Society for Academic Primary Care Conference Unit of Academic Primary Care, Warwick Medical School; 2021. Available from:

https://warwick.ac.uk/fac/sci/med/research/hscience/apc/swsapc2021/swsapc_21_conference_booklet_fnal.pdf.

Donaghy, E., Atherton, H., Hammersley, V., McNeilly, H., Bikker, A., & Robbins, L. et al. (2019). Acceptability, benefits, and challenges of video consulting: a qualitative study in primary care. *British Journal Of General Practice*, *69*(686), e586-e594. doi: 10.3399/bjgp19x704141

Dudhwala, F., & Woolgar, S. (2019). Responsibility, response-ability and responsivity: the new characteristics of accountability in the face of online patient feedback – ethnographic case studies in four NHS trusts. In J. Powell, H. Atherton, V. Williams, F. Mazanderani, F. Dudhwala & S. Woolgar et al., Using online patient feedback to improve NHS services: the INQUIRE multimethod study. *Health Services and Delivery Research,* 7(38), 49-57. doi: 10.3310/hsdr07380

Ertner, M. (2019). Enchanting, Evoking, and Affecting: The Invisible Work of Technology Implementation in Homecare. *Nordic Journal Of Working Life Studies*, *9*(S5). doi: 10.18291/njwls.v9is5.112690

Farr, M., Banks, J., Edwards, H., Northstone, K., Bernard, E., Salisbury, C., & Horwood, J. (2018). Implementing online consultations in primary care: a mixed-method evaluation extending normalisation process theory through service co-production. *BMJ Open*, *8*(3), e019966. doi: 10.1136/bmjopen-2017-019966

FDA. (2020) What is Digital Health? FDA. Accessed 06.09.2021. https://www.fda.gov/medical-devices/digital-health-center-excellence/what-digital-health

Ferrari, M., Ahmad, F., Shakya, Y., Ledwos, C., & McKenzie, K. (2016). Computer-assisted client assessment survey for mental health: patient and health provider perspectives. *BMC Health Services Research*, *16*(1). doi: 10.1186/s12913-016-1756-0

Giddens, A. (1993). *Sociology* (2nd ed.). Cambridge: Polity Press.

Glaser, B. (1965). The Constant Comparative Method of Qualitative Analysis. *Social Problems*, *12*(4), 436-445. doi: 10.2307/798843

Gooday, G. (1998). Re-writing the 'book of blots': Critical reflections on histories of technological 'failure'. *History And Technology*, *14*(4), 265-291. doi: 10.1080/07341519808581934

Greenhalgh, T., & Papoutsi, C. (2018). Studying complexity in health services research: desperately seeking an overdue paradigm shift. *BMC Medicine*, *16*(1). doi: 10.1186/s12916-018-1089-4

Greenhalgh, T., Robert, G., Bate, P., Macfarlane, F., & Kyriakidou, O. (2008). *Diffusion of innovations in health service organisations: a systematic literature review*. John Wiley & Sons.

Hans, P., Gray, C., Gill, A., & Tiessen, J. (2018). The provider perspective: investigating the effect of the Electronic Patient-Reported Outcome (ePRO) mobile

application and portal on primary care provider workflow. *Primary Health Care Research & Development*, *19*(2), 151-164. doi: 10.1017/s1463423617000573

Harrison, M., Koppel, R., & Bar-Lev, S. (2007). Unintended Consequences of Information Technologies in Health Care: An Interactive Sociotechnical Analysis. *Journal Of The American Medical Informatics Association*, *14*(5), 542-549. doi: 10.1197/jamia.m2384

Henwood, F. and Marent, B. (2019), Understanding digital health: Productive tensions at the intersection of sociology of health and science and technology studies. Sociol Health Illn, 41: 1-15. https://doi.org/10.1111/1467-9566.12898

Henwood, F., Wyatt, S., Hart, A., & Smith, J. (2003). 'Ignorance is bliss sometimes': constraints on the emergence of the 'informed patient' in the changing landscapes of health information. *Sociology Of Health And Illness*, *25*(6), 589-607. doi: 10.1111/1467-9566.00360

Johansson, A., Lindberg, I., & Söderberg, S. (2014). The views of health-care personnel about video consultation prior to implementation in primary health care in rural areas. *Primary Health Care Research & Development*, *15*(02), 170-179. doi: 10.1017/s1463423613000030

Joyce, K. (2019), Smart textiles: transforming the practice of medicalisation and health care. Sociol Health Illn, 41: 147-161. https://doi.org/10.1111/1467-9566.12871

Kim, J., & Kim, S. (2009). Physicians' perception of the effects of internet health information on the doctor–patient relationship. *Informatics For Health And Social Care*, *34*(3), 136-148. doi: 10.1080/17538150903102422

Koppel, R., Metlay, J., Cohen, A., Abaluck, B., Localio, A., E Kimmel, S., & L Strom, B. (2005). Role of Computerized Physician Order Entry Systems in Facilitating Medication Errors. *JAMA*, *293*(10), 1197-1203. doi: 10.1001/jama.293.10.1197

Lainer, M., Mann, E., & Sonnichsen, A. (2013). Information technology interventions to improve medication safety in primary care: a systematic review. *International Journal For Quality In Health Care*, *25*(5), 590-598. doi: 10.1093/intqhc/mzt043

Law, J. (1987). Technology Transfer and Social Engineering. *Social Studies Of Science*, *17*(3), 564-569. doi: 10.1177/030631287017003008

Lipsitz, L. (2012). Understanding Health Care as a Complex System. *JAMA*, *308*(3), 243. doi: 10.1001/jama.2012.7551

Lupton, D. (2014). Beyond Techno-Utopia: Critical Approaches to Digital Health Technologies. *Societies*, *4*(4), 706-711. doi: 10.3390/soc4040706

Margetts, H., 6, P., & Hood, C. (2012). *Paradoxes of Modernization: Unintended Consequences of Public Policy Reform* (1st ed.). Oxford: Oxford University Press.

McMullan, M. (2006). Patients using the Internet to obtain health information: How this affects the patient–health professional relationship. *Patient Education And*

Counseling, *63*(1-2), 24-28. doi: 10.1016/j.pec.2005.10.006

Mehrotra, A., Paone, S., Martich, G., Albert, S., & Shevchik, G. (2013). A Comparison of Care at E-visits and Physician Office Visits for Sinusitis and Urinary Tract Infection. *JAMA Internal Medicine*, *173*(1), 72. doi: 10.1001/2013.jamainternmed.305

Melby, L., & Hellesø, R. (2014). Introducing electronic messaging in Norwegian healthcare: Unintended consequences for interprofessional collaboration. *International Journal Of Medical Informatics*, *83*(5), 343-353. doi: 10.1016/j.ijmedinf.2014.02.001

Merton, R. (1936). The Unanticipated Consequences of Purposive Social Action. *American Sociological Review*, *1*(6), 894-904. doi: 10.2307/2084615

Meskó, B., Radó, N., & Győrffy, Z. (2019). Opinion leader empowered patients about the era of digital health: a qualitative study. *BMJ Open*, *9*(3), e025267. doi: 10.1136/bmjopen-2018-025267

Mol, A., Moser, I. and Pols, J. (2010). *Care In Practice: On Tinkering In Clinics, Homes And Farms*. Germany: transcript Verlag.

Morrissey, E., Glynn, L., Casey, M., Walsh, J., & Molloy, G. (2018). New self-management technologies for the treatment of hypertension: general practitioners' perspectives. *Family Practice*, *35*(3), 318-322. doi: 10.1093/fampra/cmx100

NHS. (2019). *The NHS Long Term Plan* (pp. 91-98). National Health Service. Retrieved from https://www.longtermplan.nhs.uk/wp-content/uploads/2019/08/nhs-long-term-plan-version-1.2.pdf

Öberg, U., Orre, C., Isaksson, U., Schimmer, R., Larsson, H., & Hörnsten, Å. (2018). Swedish primary healthcare nurses' perceptions of using digital eHealth services in support of patient self-management. *Scandinavian Journal Of Caring Sciences*, *32*(2), 961-970. doi: 10.1111/scs.12534

Oliver, K., Lorenc, T., Tinkler, J., & Bonell, C. (2019). Understanding the unintended consequences of public health policies: the views of policymakers and evaluators. *BMC Public Health*, *19*(1). doi: 10.1186/s12889-019-7389-6

Oudshoorn, N. (2008). Diagnosis at a distance: the invisible work of patients and healthcare professionals in cardiac telemonitoring technology. *Sociology Of Health & Illness*, *30*(2), 272-288. doi: 10.1111/j.1467-9566.2007.01032.x

Papoutsi, C., Reed, J., Marston, C., Lewis, R., Majeed, A., & Bell, D. (2015). Patient and public views about the security and privacy of Electronic Health Records (EHRs) in the UK: results from a mixed methods study. *BMC Medical Informatics And Decision Making*, *15*(1). doi: 10.1186/s12911-015-0202-2

Peek, N., Sujan, M., & Scott, P. (2020). Digital health and care in pandemic times: impact of COVID-19. *BMJ Health & Care Informatics*, *27*(1), e100166. doi: 10.1136/bmjhci-2020-100166

Peters, B. G. (2007). *The pitfalls of performance: The unintended consequences of reform. International Conference on Government Performance Management,* 17–32. Taiwan: National Chengchi University.

Peters, L., Greenfield, G., Majeed, A., & Hayhoe, B. (2018). The impact of private online video consulting in primary care. *Journal Of The Royal Society Of Medicine*, *111*(5), 162-166. doi: 10.1177/0141076818761383

Piras, E.M. and Miele, F. (2019), On digital intimacy: redefining provider–patient relationships in remote monitoring. Sociol Health Illn, 41: 116-131. https://doi.org/10.1111/1467-9566.12947

Pols, J., & Willems, D. (2011). Innovation and evaluation: taming and unleashing telecare technology. *Sociology Of Health & Illness*, *33*(3), 484-498. doi: 10.1111/j.1467-9566.2010.01293.x

Powell, J., & Arvanitis, T. (2015). Welcome to the Digital Health revolution. *DIGITAL HEALTH*, *1*. doi: 10.1177/2055207614561571

Powell, J., Gunn, L., Lowe, P., Sheehan, B., Griffiths, F., & Clarke, A. (2010). New networked technologies and carers of people with dementia: an interview study. *Ageing And Society*, *30*(6), 1073-1088. doi: 10.1017/s0144686x1000019x

Powell, J., Newhouse, N., Boylan, A., & Williams, V. (2016). Digital health citizens and the future of the NHS. *DIGITAL HEALTH*, *2*. doi: 10.1177/2055207616672033

Primack, B., Shensa, A., Sidani, J., Whaite, E., Lin, L., & Rosen, D. et al. (2017). Social Media Use and Perceived Social Isolation Among Young Adults in the U.S. *American Journal Of Preventive Medicine*, *53*(1), 1-8. doi: 10.1016/j.amepre.2017.01.010

Salisbury, Helen. Should I stay or should I go? BMJ 2021;373:n1598 doi: https://doi.org/10.1136/bmj.n1598

Sittig, D., Wright, A., & Singh, H. (2016). New Unintended Adverse Consequences of Electronic Health Records. *Yearbook Of Medical Informatics*, *25*(1), 7-12. doi: 10.15265/iy-2016-023

Stevenson, F., Hall, L., Sequin, M., Atherton, H., Barnes, R., Leydon, G., Pope, C., Murray, E., & Ziebland, S. (2019). General Practitioner's use of online resources during medical visits: managing the boundary between inside and outside the clinic. Sociology of Health and Illness , 41 (S1), 65-81. https://doi.org/10.1111/1467-9566.12833

Tonsaker, T., Bartlett, G., & Trpkov, C. (2014). Health information on the Internet: Gold mine or minefield?. *Canadian Family Physician Medecin De Famille Canadien*, *60*(5). Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4020634/

Topol, E. (2015). *The Patient Will See You Now: The Future of Medicine Is in Your Hands* (1st ed.). New York: Basic Books.

Weiner, J., Kfuri, T., Chan, K., & Fowles, J. (2007). "e-Iatrogenesis": The Most Critical Unintended Consequence of CPOE and other HIT. *Journal Of The American Medical Informatics Association*, *14*(3), 387-388. doi: 10.1197/jamia.m2338

Winner, L. (1980). Do Artifacts Have Politics?. *Daedalus*, *109*(1), 121–136. Retrieved from https://www.jstor.org/stable/20024652

Woodhouse, E., & Patton, J. (2004). Design by Society: Science and Technology Studies and the Social Shaping of Design. *Design Issues*, *20*(3), 1-12. doi: 10.1162/0747936041423262

Ziebland, S., & Wyke, S. (2012). Health and Illness in a Connected World: How Might Sharing Experiences on the Internet Affect People's Health?. *Milbank Quarterly*, *90*(2), 219-249. doi: 10.1111/j.1468-0009.2012.00662.x