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Title: The digital revolution and its impact on mental healthcare

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Abstract

The digital revolution is evolving at an unstoppable pace. Alongside the unprecedented explosion of digital technology facilities and systems, mental health care is under greater pressure than ever before. With its emphasis on big data, computing power, mobile technology and network information, there is no doubt that digital technology will transform healthcare delivery. This article reviews the field of digital health technology assessment and intervention primarily in secondary service mental healthcare, including the barriers and facilitators to adopting and implementing digitally-mediated interventions in service delivery. We consider the impact of digitally-mediated communication on human interaction and its potential impact on various mental states such as those linked to mood, anxiety but also well-being. These developments point to a need for a theory-driven approach to digital healthcare. We argue that, as developments in digital technology are outpacing the evaluation of rigorous digital health interventions, more advanced methodologies are needed to keep up with the pace of digital technology development. The need for co-production of digital tools with and for people with chronic and mental health difficulties, and implications of digital technology for psychotherapy practice, will be central to this development.

Introduction

Take hold of the future or the future will take hold of you. – Patrick Dixon, 2007.

(Dixon, 2011)

Mental health problems are on the rise and well-being is declining. Mental health problems are one of the main causes of global and societal burden and are a growing public health concern (WHO, 2014), with a recent World Health Organisation (WHO)-led study estimating that depression and anxiety disorders alone cost the global economy US\$ 1 trillion each year in lost productivity. Indeed, mental health problems constitute the largest single source of global economic burden, greater than cardiovascular and other physical health diseases (Mental Health Foundation, 2016). Problems such as depression, anxiety and substance misuse are some of the primary drivers of disability worldwide and a major contributor to a range of both physical and mental health problems (mhGAP, 2013). More severe mental health problems, such as psychosis, affects 24 million people worldwide, with the current cost to society estimated to be £11.8 billion per year in England alone (The Schizophrenia Commission, 2012).

Health services both nationally and internationally are under-resourced and are struggling to keep up with the growing cost of an aging population with increasingly complex healthcare needs (NHS, 2014). Unfortunately, many people with mental health problems around the world have limited, if any, chance of accessing psychological help at all. As such, technological innovations and solutions are being considered in an attempt to address the size and scale of the mental health crisis worldwide. To this end, we are in the midst of a digital revolution. Central to the digital revolution is mobile access to the world wide web, digitally-mediated communication and the mass uptake of smartphones. The amount of information and processing power at our fingertips has revolutionized the way we gather information, seek help and communicate with one another. Mobile technology and the immediate and ubiquitous access to information, as well as intentional and unintentional digital authorship, has also changed how we engage with services and challenges the notion of data ownership. Digital technology has already dramatically transformed a number of sectors, and with its emphasis on big data, computing power, mobile technology and networked information, this digital revolution will also ultimately transform healthcare.

The purpose of this special edition is to highlight the importance of social context and how this is conducive to mental well-being, and to move towards an integrative process way of thinking about mental health problems, mental and social well-being, and therapy. Underpinning this work, we acknowledge the now unequivocal evidence that social and environmental factors play a major role in the occurrence and severity of mental health problems. The so-called psychosocial determinants of mental health include adversities such as poverty, living in urban environments, poor housing, belonging to an ethnic minority, childhood maltreatment and bullying (Varese et al., 2012), just to name a few. These social and environmental drivers of mental ill-health are thought to be largely influenced by current capitalist competitive societal structures. Digital technologies now also play an important role when considering social context. The now seemingly constant exposure to and connection with others and their lives has the potential to be both positive and negative.

This paper will highlight some of the challenges mental health services face in delivering high quality, efficient, and timely person-centred care. We also explore how an integrative process way of thinking about mental health problems and well-being can be achieved in the digital space, whilst ensuring this is not at the expense of investing in underlying social structures that often drive inequalities. Finally, we discuss why it is important to consider the vital role the digital space plays in modern day social context.

The boom in self-monitoring, self-management and digital health interventions (DHIs)

The use of technology worldwide has increased rapidly, with a recent survey highlighting current UK household internet access at 90% (Office for National Statistics, 2017). Smartphone adoption amongst UK adults has reportedly risen from 52% to 85% in the past five years alone (Deloitte, 2016), including individuals with severe mental health problems (Firth et al., 2016). This growing rate of technology access and smartphone ownership highlights the potential for treatment and engagement with services to be taken from the clinic into the context of an individual's everyday life, unconstrained by location and time.

Digital platforms afford people the ability to self-monitor and self-manage in a way that face-to-face and paper-based methods of assessment have up until now not allowed. These platforms are increasingly becoming the medium through which

assessment and intervention is taking place. In fact, talking to people in person is not necessarily an individual's first choice method of communication. Several studies have now shown that some people actively choose to seek help and support from peers online via forums and social media websites (Berry, et al., 2016), while others prefer to communicate their feelings and experiences about their wellbeing and mental health using online blogs (Batterham & Caley, 2017).

Self-management of mental health problems has become a cornerstone of mental health policy, as digital systems have the potential to drive improvements in service efficiency and costs, treatment access, shared decision-making and the provision of ecologically-valid data that could aid clinicians in treatment decisions. An increase of contextual information being generated and actively shared by individuals further has the potential to increase agency, governance and true collaborative care led by people who experience mental health problems rather than observed clinical need. Research groups are also turning their attention to the potential uses of technology to deliver self-guided psychological interventions for people who experience mental health problems. In this section, we highlight the ways in which researchers are currently incorporating digital platforms to deliver mental health support and treatment.

Assessment

There are a number of ways digital tools can be involved in mental health assessment and bring us steps closer towards measurement-based care and not clinical judgement alone. Hatfield and colleagues (2010) found that mental health practitioners accurately detected deterioration in only 21.4% of people who experienced significant increase in symptom severity, which was identified as failure to track changes in mood, cognition and behaviour. Apps that track symptoms typically involve repeated assessments of specific variables micro-longitudinally to identify how these variables relate to each other over time. Individuals are usually prompted by an electronic device to complete assessments at various points, multiple times a day over a pre-specified time-period (Shiffman, et al., 2008). These self-monitoring tools provide opportunities to observe fluctuations in symptoms, self-regulate, and/or share this information with carers / healthcare professionals. Examples include: i) ClinTouch (Palmier-Claus et al., 2012), a symptom-monitoring app for psychosis that triggers, collects, and wirelessly uploads symptom data (e.g. positive psychotic symptoms, anxiety, and mood) to a server; ii) MONARCA, a symptom-monitoring app for bipolar disorder that allows individuals to enter and track

items including mood, sleep, alcohol consumption, stress and individualized early warning signs with a feedback loop for both users themselves and their care team (Faurholt-Jepsen et al., 2015); iii) an app and clinician dashboard utilizing Ginger.io that collects passive data (e.g. movement, SMS messages, phone calls) and active data (self-report surveys) for use and review by an individual's care team (Niendam et al., 2018); and iv) digital phenotyping approaches (Insel, 2017), where smartphones are being used to passively collect their meta-data, including natural language processing (analyses voice speech data), sensors measuring activity (location services) and human computer interaction keyboard performance (typing, clicking) to develop a digital biomarker that can be used to aid diagnosis and predict relapse.

Therapy

Digital tools are also being used to assess fluctuations in people's daily life experiences and in delivering guided self-help and health interventions. Some digital tools primarily deliver psychoeducation about difficulties, which aims to provide people with accessible, systematic, structured and interactive information that normalize, and help people cope with, challenging experiences (Ben-Zeev, Davis, Kaiser, Krzsos, & Drake, 2013; Ben-Zeev et al., 2014). Apps have also been developed to increase access to mindfulness-based approaches for people with Bipolar disorder (Murray et al., 2015) and those accessing acute psychiatric care (Mistler, Ben-Zeev, Carpenter-Song, Brunette, & Friedman, 2017). Researchers have also been incorporating predominantly cognitive-behavioural approaches within apps and websites to help people self-manage their experiences and provide advice/help and psycho-education about difficulties and as augmentation of face to face treatments. Recent examples include: i) Coping with Voices, an interactive web-based programme that aims to reduce the severity of auditory hallucinations by promoting the use of self-assessments and subsequent coping strategies for self-help (Moritz, et al., 2016); ii) HelpID, which delivers 12 weekly sessions including exercises, relaxation guidance, graphs to visualize experiences and interactive information about symptoms (Moritz et al., 2016); iii) MoodSwings-Plus online programme for bipolar disorder that combines CBT and psychoeducation with social networking opportunities for social referencing and social linking, as well as motivational interviewing techniques, monitoring and cognitive strategies (Lauder et al., 2017); iv) Actissist, a cognitive behaviour theory-informed app that offers self-help strategies, psycho-education and targets key aspects of early psychosis relapse factors (Bucci, et al., 2018); and v) SlowMo, a digital intervention that includes an

interactive web-based app that facilitates delivery of face-to-face meetings which are then synchronised with a mobile app for use in daily life. SlowMo targets a 'fast thinking' reasoning style associated with paranoia, characterised by jumping-to-conclusions and belief inflexibility (Garety et al., 2017).

Many of these new digital tools are either under clinical trial or are at the proof-of-concept phase and require more in-depth testing; they have not been tested in head-to-head comparison trials with standard therapy delivery. Some of these digital tools are designed to work in conjunction with routine therapy delivery (e.g. SlowMo), whilst others are designed to be offered as a stand-alone self-help intervention (e.g. Actissist). The issue of whether these systems will be used to replace, used as an adjunct, or augment therapy is an empirical one and depends on the context in which a person is seeking support. For example, for those in remote communities, a stand-alone self-help intervention might be the only possible option for receiving support. Someone living in a more urban context with access to therapist-led interventions that use digital tools to augment sessions or where these tools can advance the work of the therapist (e.g. facilitate between session tasks/activities) may benefit more from systems that are designed to be used in conjunction with a therapist-led intervention. Depending on the context, it is useful for a variety of digital systems to be developed to give people choice and to ensure maximum scalability of self-management tools.

Digital tools and well-being

Well-being is now part of the national core curriculum for schools in many developed countries. Following this growth in focus, digital tools are also being developed and used to support well-being. For example, 'five steps to mental wellbeing' (NHS Choices, 2016) is a resource focused on five well-being areas for people to use in their everyday life: connect with others; be active; keep learning; give to others; be mindful (see Taylor et al., 2017).

For a more comprehensive review of well-being apps developed for young people specifically. Apps targeting well-being have shown potential for enhancing well-being across a number of studies. For example, a mindfulness-based mobile intervention for individuals "seeking happiness" demonstrated significant increases in positive affect and decreases in depression (Howells, Ivtzan & Eiroa-Orosa, 2017).

Furthermore, a recent randomised controlled trial of three publicly available apps in a community sample: i) MoodKit (CBT toolkit app); ii) MoodPrism (mood tracking app); and iii) MoodMission (CBT strategy app) reported increases in mental wellbeing after

engagement with all apps compared with a waitlist control condition (Bakker, Kazantzis, Rickwood & Rickard, 2018). Additionally, the NHS have relaunched a new beta website (www.apps.beta.nhs.uk), which lists several smartphone apps aiming to improve well-being that have been assessed as meeting NHS standards for safety, accessibility and usability. Moreover, internationally, the Australian Department of Health provide an online resource Head to Health (www.headtohealth.gov.au) that also provides details for well-being apps and online courses. Therefore, in addition to providing symptom-targeted interventions via digital technologies, there is also a drive to improve well-being more generally to help people live happier and more meaningful lives as a preventative strategy for future mental health problems.

How are people currently using technology to support their well-being and mental health?

Despite some reported drawbacks of digital engagement and communication, there is evidence for the positive impact of digital devices in peoples' lives. For the past few years, our group has been talking to individuals experiencing severe mental health problems and the staff who are involved in their mental health care about the role digital technology has played in their lives. Here, we summarise how individuals currently use technology in the process of trying to improve, or seek support for, their own mental health and wellbeing (see Table 1).

Information gathering

A common strategy some individuals with severe mental health problems use to self-manage is to use digital devices/tools/systems/platforms to access information about mental health problems on the Internet. Recent surveys have reported rates of mental health online information-seeking by people with severe mental health problems of between 38% and 78% (Gay, Torous, Joseph, Pandya, & Duckworth, 2016) (Bauer et al., 2016); Bonet et al. (2018). Additionally, qualitative studies reveal that many people interviewed with psychosis describe searching for information about mental health online to aid their own understanding of their experiences, to read information about medication, side effects and diagnosis, and to seek information about coping skills (Aref-Adib et al., 2016; Lal, Nguyen, & Theriault, 2018). Although using the Internet to access information about mental health can be beneficial, concerns regarding the abundance of unregulated material have been highlighted. For example, some people experiencing psychosis have expressed a reluctance to use the internet to access mental health-related information due to feelings of being overwhelmed and difficulties with concentration (Schrack et al.

2010) Additionally, focus groups with staff working with people accessing secondary care services in the UK revealed that staff were concerned about the quality of online mental health-related information and had experienced situations where individuals had accessed information that had led to them engaging in activities that had been harmful; for example, buying medication online (N. Berry, Bucci, & Lobban, 2017). In light of these findings, clinicians should consider the abundance of information people may have access to and be prepared to discuss this information in consultations and appointments.

Reaching out

People with severe mental health problems also report using forums and social media websites in order to self-manage and improve their mental health. Mental health-related discussions on Twitter to connect individuals is widespread and, for this reason, Twitter has been described by the UK mental health charity Mind as one of the most important places on the Internet for dialogues about mental health. In a recent study, Twitter users were asked to detail the reasons why they discussed their mental health problems on the Twitter platform (Berry et al., 2017). Respondents described the importance of being able to reach out and seek support when they were unable to leave the house or if they were reluctant/unable to reach others in a face-to-face setting. Respondents also said that social media platforms such as Twitter enabled them to access motivational content by viewing the experiences of others, which provided hope for future recovery. Potential dangers of social media use aside, social media further provides opportunities for social referencing; hearing about another's experience can be de-shaming and provide opportunities for social linking. Indeed, social media affords people the opportunity to recognise that they are not necessarily alone, which can be profoundly powerful for those who feel isolated or live in isolated communities.

Such connections and ease of access to support could be incorporated within DHIs, offering individuals timely access and relevant help and support in the context of the environment(s) in which they feel most at ease. Such integration in one standalone app or online programme could allow users to use a combination of therapeutic approaches as a form of self-management. For example, learning about different aspects of mental health through interactive psychoeducation; working to overcome problems using embedded CBT-informed techniques; and then subsequently discussing experiences on the social networking component for peer support,

encouragement, developing a shared understanding and feeling supported by others during this process.

A new social context

A key survival tool, humans have evolved to be highly social; social communication and development is now taking place in the digital space. Never before have we experienced our current level of connectivity, and yet it seems that we are also more isolated and increasingly lonely than ever before. What, then, is the fundamental disconnect and the impact of removing face-to-face interaction? Did the digital revolution foresee this unintended consequence, whereby society is paradoxically more *and* less socially connected than ever before?

Socio-political context

In an aging population, and with mental health problems on the rise and well-being declining, demands on health services are greater than ever. There is some speculation that the drive for digital technologies, now a cornerstone of healthcare policy in the UK, is motivated by governments considering technological solutions to healthcare as a cheaper option to public service provision (e.g. employing more staff) or primary prevention campaigns. The effects of neoliberalism, with its focus on privatisation, withdrawal and cuts on basic state support and benefits, unemployment and unstable work conditions, might be partly to blame (Lupton, 2014) with the move away from a political discourse that champions the need to lessen socioeconomic disadvantage, develop communities and reduce social inequalities. Whilst digital solutions have huge potential to bridge the healthcare gap, improve scalability of services, and reach and connect people in a way that is unconstrained by time and location, caution is warranted to ensure that public service provision remains at the forefront of healthcare policy and government initiatives around mental health and well-being. Lupton (2014) contends that many digital health promotion strategies focus on the individual, placing responsibility for one's own health within the individual, thereby failing to recognise the importance of social, cultural and environmental dimensions of not only mental ill-health, but also digital technology use

The impact of social media and social comparisons

Modern society has become used to information on-demand; social order is viewed as something that can be engineered and improved at will (Harari, 2014). The use of

social media websites such as Twitter, Facebook and Instagram are widespread and controversial. Social media websites allow people to construct profiles in which they can maintain and create social networks, circulate details about their daily lives and respond to posts written by others. The social psychologist Festinger (Festinger, 1954) initially proposed that the inherent drive for individuals to achieve accurate self-evaluation of opinions and abilities is driven by social comparisons. Social comparison theory suggests that individuals evaluate their own views and abilities by comparing themselves to others in order to regulate their own sense of self. Social comparisons lead to the development of social ranks, whereby individuals compare themselves to others on relative power and social attractiveness via upward and downward social comparisons (Lee, Barrowclough, & Lobban, 2014). Such social comparisons may be particularly problematic for people who already experience low mood or self-esteem. For example, Swallow and Kuiper (1988) found evidence suggesting that individuals experiencing depressive symptoms were more likely to exhibit negative self-evaluations. Additionally, a questionnaire-based study with 913 student participants found that individuals experiencing depression were more likely to have a negative reaction towards upward social comparisons than controls (Bazner et al., 2006).

It is easy to see how social comparison theory can be applied to social media platforms that are used today, and the effect these platforms are having on mental health and well-being. Engaging with others via social media platforms may elicit negative social upward comparisons whereby individuals compare themselves less favourably to others, leading to negative feelings about the self. Social media may further facilitate the formation of social ranks due to the tendency for people to present themselves and their experiences in a predominantly positive light (Manago, Graham, Greenfield, & Salimkhan, 2008; Zhao, Grasmuck, & Martin, 2008). Social media affords control over how others see us, so that rather than portraying our vulnerabilities, socially-mediated profiles can be edited and displayed under our control (Manago et al., 2008). This is particularly evident on some social media platforms such as Instagram which appear to have an enhanced social comparison element particularly in relation to body-image. Slater and colleagues (2017) experimentally examined 160 undergraduate women's body satisfaction, body appreciation, self-compassion and mood when exposed to 'fitspiration' images, self-compassion quotes or appearance-neutral images. Self-comparison attenuated the negative impact of social media images on body satisfaction when compared to fitspiration images alone.

Researchers working in the field of social comparisons and psychopathology have proposed that perceived social rank is associated with mood and self-esteem (Gilbert, 2000). Indeed, negative social comparisons on social media websites are associated with depression, low self-esteem (Berry et al., 2018; de Vries & Kühne, 2015; de Vries, Möller, Wieringa, Eigenraam, & Hamelink, 2018; Feinstein et al., 2013; Lup, Trub, & Rosenthal, 2015), paranoia (Berry et al., 2018) and negative cognitive bias (Østergaard, 2017). It seems, then, that social media platforms, and the comparisons individuals make on these platforms, can hugely impact one's mental state. As such, understanding patterns of social media behaviour is another area where clinicians must be mindful of how such behaviours might effect an individual's mood, self-esteem and well-being more generally.

It is possible that digitally-mediated communication is also driving the increase in reported subjective experience of loneliness, a growing social problem observed across societies. Loneliness is the subjective experience of social isolation and is experienced when there is a discrepancy between the type of interpersonal relationship one wishes to have compared to relationships one perceives to have (Perlman & Peplau, 1982). Humans have an innate need for belonging (Heinrich & Gullone, 2006; Beutel et al., 2017); the subjective experience of loneliness is related to the quality (not quantity) of human relationships (Lim & Gleeson, 2014). Digital technology has become the new mediator of our social interactions and has, for some, become the preferred method for communication. Putting factors such as living in more nuclear families away from extended family aside, engaging in digitally-mediated means of communication rather than face-to-face contact appears to have impacted on reported rates of loneliness. Related to loneliness is social support and a sense of belonging, which have important implications for well-being and mental health. Although people who report feeling shy and introverted prefer digitally-mediated forms of communication as they provide time, distance and control over communicating (Hession, 2016), self-representation on social media platforms also allows for much stronger compartmentalisation of self-image; we are encouraged to portray only aspects of our lives and self-perception which can lead to highly skewed and biased interactions and a lack of connectedness. It is possible, then, that the very nature of mediating communication through digital technology has also made us feel less, rather than more, meaningfully and closely connected to others.

Digitally-mediated communication and mentalisation

A key human experience is developing the ability to think about one's self and others in terms of mental states, understanding what might motivate people to say or do things, developing empathy and affiliation plus being able to relate to others in terms of their emotions, motivations and intentions (Fonagy & Target, 2006). In day-to-day interactions, the ability to take the perspective of others supports to prepare and plan our behaviours and make social exchanges somewhat predictable (Fonagy, 2004). However, the ability to judge others' intentions and motivation within digitally-mediated conversations can be more difficult as trust and empathy are often assumed and signals to the contrary are more hidden in the online space. It is possible that removing the human interaction we encounter in face-to-face social situations will impact on an individual's ability to mentalise. In an experimental study examining mentalisation and its neurocognitive correlates in human to human vs human to computer interactions, Kircher and colleagues (2009) found the same activation patterns in both sets of interactions. However, much stronger signals were found when participants were confronted with a human partner, indicating stronger mentalization activity in human-to-human interactions compared with digital interactions.

A key issue in the online environment, for example, is for people to mentalise themselves and others in this online space, which is characterised by a high level of compartmentalisation and projections and non-reciprocal interactions. A significant risk factor for people will be their ability to accurately estimate others' intentions and motivations, trust and understanding, when engaging in online environments as one's assumptions are based on real life relationships, where signals of empathy and understanding are transmitted less opaquely. Assumptions based on our real-life interactions carried into communications in a digital space may well render individuals more vulnerable to exploitation and may in turn undermine the epistemic trust that allows for further social learning and meaningful interactions in this space. Furthermore, a consequence of digitally-mediated communication is that feedback loops that reinforce communication and mentalising ability developed in face-to-face interactions might fundamentally alter our understanding of communication as a one-way process as we never see the consequences our messages or actions on others (Hession, 2016). The digitally-mediated environment removes contextual and social cues we see in personal interactions that help mitigate misunderstandings. Might this impact our ability to regulate emotions and empathise with others? The potential to misattribute peoples' intentions due to the lack of nonverbal cues and the possibility of the reduced emotion regulation and empathy due to digitally-mediated

communication may be particularly problematic for individuals experiencing mental health problems. Therefore, the impact of predominantly digitally-mediated communication on developmental trajectories of mentalising ability and capacity, particularly amongst young people, requires serious and urgent consideration.

Digital tools and the therapeutic relationship

The therapeutic relationship (also termed working alliance) relates to the quality of the therapist-client interaction, the collaborative approach taken in working towards the tasks and goals of therapy, and the personal bond or attachment that emerges in therapy (Bordin, 1975). It is now well-established that the therapeutic relationship is important in predicting therapy outcomes (Baldwin, Wampold, & Imel, 2007). How, then, does this relate to digitally-mediated forms of communication?

Attachment styles are evident in response to separation, reunion and loss with, typically, a primary caregiver. Extending this logic, some researchers have generalized our ties with social contacts (i.e. attachment frameworks) to inanimate objects such as smartphones (Bodford, Kwan, & Sobota, 2017), or rather what they represent in terms of social relationships and networks, citing evidence that people form attachments not only to others but also to a range of inanimate objects and the personal meanings these objects represent and can experience grief reactions when ties are severed. It seems unlikely that we can truly form a reciprocal alliance or attachment, in the traditional sense of the concept, with unsupported digital technology directly (e.g. a smartphone app). However, members of our group explored the concept of therapeutic alliance, defined as the quality of the relationship between a clinician and person using mental health services, with an app currently under clinical investigation. Our aim was to explore whether people reported forming relational ties with the app they used in the context of a DHI trial. We explored the concept of therapeutic relationship directly with the smartphone app Actissist (Bucci, Barrowclough, et al., 2018), a theory-informed app for people experiencing early psychosis. A qualitative exploration of the concept of therapeutic alliance with the smartphone app showed that people with recent onset psychosis difficulties felt supported by the app and reported missing the app when it was no longer available. The perceived loss of the app and the sense of security it provided (e.g. instant support offered at their time of need) suggested that participants had formed a relational bond with the app, or rather what the app represents within their care and support context. Participants also described building a supportive relationship with the app and described relational qualities between themselves and the app (K. Berry,

Salter, Morris, James, & Bucci, 2018). In support of these findings, other qualitative research has found that young people display sentimental and anthropomorphic views towards their mobile phone (Fullwood, Quinn, Kaye, & Redding, 2017) and that online therapeutic relationships can be as strong as the therapeutic alliance in face-to-face relationships (Dunn, 2018).

The issue of therapeutic alliance has also been explored in therapy delivered online (without a therapist) among young people. Anderson and colleagues (2012) evaluated therapeutic alliance of CBT delivered in a clinic or online for children and adolescents who met diagnostic criteria for anxiety. For children and adolescents, there was no difference in the strength of the therapeutic relationship developed between the two delivery approaches. However, parents of participants reported a higher working alliance in clinic-based therapy. Given that we know how important the therapeutic relationship is in predicting therapy outcomes, studies such as this, may suggest that 'digital natives' have a different relationship with technology compared with a 'digital immigrant' generation.

Although in its infancy, it seems more likely that smartphones form attachment representations. For example, as adults, we internally represent internal working models of our relationships with others and project these representations onto others, including other objects. We would argue that it is not necessarily the digital platform itself, rather the internal representation of the relationships and networks the platform represents. Social media interactions and indirect reinforcements on these platforms can therefore be as powerful as real world interactions. In this context the app or app related to a mental health treatment and support plan will represent the value and feedback associated with care relationships and be equally influenced by patterns of relating and styles of attachment. This area requires significantly more research to unpack the nature of the relationship people seem to display with digital technology, with a view to exploring the impact of this relationship on clinical and functional outcomes.

Facilitators / Barriers to digital platforms in mental healthcare

Digital innovation is central to mental health service reform worldwide (Bhugra et al., 2017; NHS, 2014). Services such as the NHS will not be sustainable without drawing on technological innovations (NHS, 2016). Although the NHS has prioritized a digital agenda across health care services, it has been widely criticised for previous failings with attempts of integrating technology into healthcare. The digital revolution within

health care services relies on people to make this a values-driven, ethical and sustainable transformation. As such, a cultural shift in organizational and staff attitudes is required.

Attitudes towards the development of digital health interventions in mental healthcare

Recent work has focussed on potential barriers to uptake and implementation of DHIs within mental health care settings. Such barriers include a range of organisational and staff-related including: perceptions regarding user motivation; reliable Internet access and computer and literacy skills requirements; lack of staff training to use digital devices/tools/systems/platforms; perceived loss of the therapeutic relationship through digitally-mediated communication; inability to identify risk issues; and the potential for disengagement with services due to the lack of face-to-face contact (N. Berry et al., 2017; Hennemann, Beutel, & Zwerenz, 2017; Stallard, Richardson, & Velleman, 2010).

We have previously mentioned the current drive for digital technologies in health care may be, in part, due to the socio-political context of cost-cutting exercises to promote individual coping and reduce service dependence. This current social context may influence service, staff and user views towards the implementation of new health care solutions; a notion that has been reflected in our recent qualitative work ((N. Berry et al., 2017; Bucci et al., 2018). Specifically, both staff and people using mental health services were suspicious about the use and storage of data gathered via digital devices. For example, some raised concerns that government organisations such as the UK department of work and pensions or commercial/pharmaceutical organisations could gain access to such data, leading to confidentiality breaches, potential exploitation by companies, and as a rationale to justify reductions in disability payments. There was also the distinct concern that health care services would use DHIs as an inferior replacement for face-to-face care to “fob people off”. Such a critical eye to the burgeoning use of digital technologies raises questions around the drivers for self-monitoring and self-management at the expense of broader initiatives such as community development, staff investment and training, and primary prevention programmes, to name a few (Lupton, 2014).

Our focus groups and interviews with staff and service users also highlighted a barrier expressed by some that digital tools could facilitate avoidance behaviour, thereby maintaining distress. Indeed, an individual may express a preference for

mental health support via a digital platform, but staff may question whether is this the support they need? Is this desire motivated out of fear of face-to-face interaction, maintaining high levels of safety? Conversely, staff can also see that digital platforms might facilitate engagement with services by acting as a bridge for communication with service users, with increased convenience and availability for the user (vs the restricted availability of mental health care staff). Therefore, staff can see the potential for digital platforms to establish an avenue for future contact if an individual is disengaging from traditional services (Stallard et al., 2010; Vigerland et al., 2014).

These findings from both qualitative and quantitative data highlight a magnitude of potential attitudinal facilitators that must be endorsed in order to improve the likelihood of implementation and uptake, but also several attitudinal barriers that have the potential to jeopardise the future of digital tools in mental health care services.

Digital tools are being developed without considering theory

An additional barrier to the potential implementation of DHIs is the current race to develop these tools without the consideration of theory. This means that although the feasibility and efficacy of digitally-mediated tools is proving fruitful, how and why they work is less clear. How are we able to encourage implementation without being able to justify the way in which they work to services? To understand how and why these tools are effective, we need to turn to research exploring the underlying processes by which they seem to be operating. Whilst psychological research and principles underpin the content of some digital tools currently under clinical trial (e.g. (Ben-Zeev et al., 2014; Bucci, Barrowclough et al., 2018; Schlosser et al., 2016)), a distinction needs to be made between psychosocial models and research that underpin and inform the content of a digital system, versus the potential processes by which self-monitoring and managements tools exert their effect.

For example, self-determination research and theory (SDT) highlights the need for autonomy, competence and relatedness to promote intrinsic motivation and enhanced mental health (Ryan & Deci, 2017). Schlosser and colleagues (2016) integrated principles of SDT into the design and structure of PRIME, a DHI designed to target reward-processing impairments, enhance motivation, and improve quality of life in people with a recent diagnosis of schizophrenia. In relation to healthcare, SDT suggests that individuals sometimes lack the opportunity to make autonomous

choices in engaging in health-promoting behaviours, competence in driving reward learning and relatedness (Ryan & Deci, 2017). Schlosser and colleagues (2016) suggest that DHIs might exert their effect by fostering relatedness and empowering individuals with the tools needed to be autonomous and competent, driving intrinsically motivated behaviour and, in turn, affording people more control over their well-being.

From a different perspective, digital tools have the distinct ability to provide a visual representation of emotional experiences and fluctuations, behavioural activity, and cognitive appraisals. That is, self-monitoring and self-management systems allow individuals to visually track their experiences. According to Morrison (2015), visual representations of internal states may provide a significant shift in how emotional and physical states are conceptualised, expressed and represented. That is, the visual representation of emotional and bodily experiences may in itself alter the experience by making what once was hidden and abstract, transparent, visible, knowable and, consequently, manageable. Whilst visually representing bodily states is not particularly new in healthcare (e.g. X-rays, ultra sounds during pregnancy, bone scans), it is arguably a relatively new concept in mental healthcare. Emotional and cognitive states are typically assessed by subjective, episodic reports or based on clinician-administered semi-structured interviews that require clinicians to make inferences and judgements about an individual's internal mental state. Monitoring, tracking and self-management tools arguably allow for more objective, continuous and ubiquitous management (Hirschtritt & Insel, 2018) that are measurable and observable by the individual directly.

Another perspective may be offered by the 'disinhibition effect' (Hanley & Reynolds, 2009) observed in digitally mediated communications. For individuals with less secure attachment styles, social shyness and higher levels of anxiety, the perceived distance offered by an online space and digitally mediated communications can promote more rapid disclosures and openness. At the same time the 'unseen' nature of the interactions facilitates stronger projections of emotions, intentions and motivations and a more readily assumed identification, enabling social learning in an ever changing social and cultural context. It is beyond the scope of this paper to provide an in-depth consideration of how and why self-monitoring tools and DHIs might exert their effect; however, we urge the research community to consider the mechanisms by which these approaches impact on outcomes across a range of mental health problems.

Digital technology is outpacing the evaluation of rigorous and robust intervention

Digital platforms provide a unique opportunity to connect with people in the context of their daily life. A limitation of face-to-face assessment and interventions is the clinician is not able to collect data in-the-moment or indeed impact people at their greatest time of need. There is an inherent mismatch between the rather static nature of providing therapy in the clinic, and stressors that are momentary and contextual in nature (Naughton, 2017). This is where the digital revolution may have its impact on developing evidence-based interventions that are rapidly available and accessible at the time it is most needed. The challenge is for staff to adapt and evolve at a pace that reflects digital technology development to ensure such developments do not outpace uptake and implementation. This also presents a methodological challenge to the way the evidence is currently developed, as we consider next.

Researchers traditionally rely on using the gold standard randomized controlled trial (RCT) to explore the efficacy of psychosocial interventions in mental health. However, RCTs are time consuming and don't in fact show which aspects of the intervention are effective (or not). Also, in standard RCTs, the intervention is typically fixed at trial outset and is not permitted to evolve over the course of the study. For many drugs undergoing clinical trial, or for complex interventions, this is indeed reasonable. However, this is problematic for digital approaches given the fast-paced development of the technology used to deliver the intervention. Fixing the intervention at trial outset could render the technology outdated or obsolete by the end of the trial period (Bucci, Lewis, et al., 2018). Newer methodologies, such as 'just in time adaptive interventions' (JITAI) that use digital technology as the modality for intervention delivery, may be the optimal platform to provide timely, contextual, in-the-moment support to people with severe mental health problems. This is partly because they may experience difficulty recalling or using treatment strategies during stressful periods where pressures on cognitive load and resources are often most apparent (Naughton, 2017). JITAI is a methodology that aims to provide the right type and amount of support, at the right time by adapting to one's changing internal and contextual state (Nahum-Shani et al., 2017). Other adaptive approaches, such as the Multiphase Optimisation Strategy (MOST) are being used in health behaviour change interventions for physical health problems (Collins, 2018; Schlam et al., 2016) and enable more efficient investigation regarding what components of an

intervention do and do not work by optimising an intervention in the initial stages of study development which can then be evaluated in an RCT (Collins, 2018). These adaptive methodologies are showing huge promise in improving the efficiency with which interventions can be disseminated and implemented and should be increasingly considered in the context of DHIs in mental health.

Co-production

Achieving a digital vision of mental healthcare must involve clinicians and frontline staff working together to design and implement healthcare technologies. Rather than exploring what people with mental health difficulties want from a digital intervention before it is developed, many research groups have sought views once development is complete. Collaboration, rather than consultation, is required to identify design features and content that should be included in order to improve the acceptability of digital approaches. The role mental health professionals play in the success of implementing digital platforms cannot be underestimated. The engagement of people with mental health issues who are in touch with services has been repeatedly linked to outcome (Hibbard, Mahoney, Stock, & Tusler, 2007; Marks & Allegre, 2005). The well-known problems with engaging in online/digital tools is thought to be, at least partly, accounted for by not considering individual user perspectives, including their insights, creativity and wisdom in content, as well as delivery when designing these online/digital tools (Marks & Allegre, 2005). With such partnership, it will be important to work out ethical issues of intellectual property as well as data authorship and governance when including wearable technology. Artificial intelligence driven algorithms and passive data collection approaches should not perpetuate an outdated model of passive expert-led medicine.

Finally, collaboration and co-production are likely to optimise acceptability and subsequent implementation and uptake of not only digital approaches to mental healthcare but all types of therapy delivery. These should not be one-off arrangements – an iterative process of built-in feedback systems to explore usability is needed to ensure continual improvement and development of the system.

Implications for digital systems on psychotherapy practice

As computers smartphones and other devices have come to play an increasing part in our lives, it is fair to say that communication more generally has become increasingly mediated by technology (Hession, 2016). If people would rather text than talk, what does this mean for the way we offer and deliver interventions

designed to help people with mental health problems, especially those who seek out help from services? Whilst this method of communication helps us connect with each other in ways that were not previously possible, there is some suggestion that this method of communication disrupts the feedback loops that reinforces healthy two-way communication (Hession, 2016). In the most extreme case, what if, as a species, our communication becomes only mediated by technology? As we move into the digital revolution era, it is important to consider how the aforementioned platforms and the changing way people communicate with one another will impact psychotherapy practice. One example of course would be the use of face time or other video functions where individuals can indeed communicate face-to-face at least to some degree. Telemental health approaches, the use of telemedicine to provide mental health assessment and treatment at a distance, has significantly scaled up access to services. Although few groups have addressed specifically effectiveness of Telemental health approaches (Hilty et al., 2013), recipients report facilitated empowerment, safety and more honest communication in light of the psychological and physical distance. These approaches have also demonstrated effectiveness for diagnosis and assessment across groups and settings and are comparable to in-person care, complementing other services particularly in primary care (Hilty et al., 2013).

Researchers are also examining whether people are willing to disclose sensitive information to an impartial 'virtual human' animated character without fear of negative evaluation. The implications of this research raise serious questions around the future of the role of therapists. In fact, this issue has been explored since the first use of computers for communication (Weisband & Kiesler, 1996), with consistent findings showing that computer-administered assessment methods solicit more honest, open responding of personal information (Lucas, Gratch, King, & Morency, 2014). Several features in "the human element" are important in increasing rapport, including both verbal and non-verbal behaviour. Technology developers are now able to incorporate these elements into the development of 'virtual humans'. Honest responding is particularly important in the mental health setting where the ability to develop a treatment plan relies on a participant's self-report of experiences and distress. Lucas and colleagues (2014) conducted a study that examined disclosure of medical history to a 'virtual human' controlled by a computer in a sample of people recruited via a classified advertisement website. Participants reported lower fear of self-disclosure, showed negative emotions more intensely, and were more willing to

disclose personal information than participants allocated to a human-controlled 'virtual human'. The 'virtual human' controlled by a computer allowed participants to feel as though their responses were not being judged by another human; when individuals fear of judgement is strong, they begin to engage in impression management and as a result withhold information that might threaten their reputation (Lucas et al., 2014). These findings require testing in the mental health context.

Using the Delphi method, Norcross and colleagues ((Lucas, Gratch, King, & Morency, 2014) asked 70 psychotherapy experts to predict the greatest psychotherapy trends in the next decade. The top five predicted changes in therapy delivery were: online therapies, smartphone apps, self-help resources beyond books, virtual realities and social networking interventions. If these predictions come to light, they will have enormous impact on the practice of psychotherapy, historically bound in the tradition of an hour long, face-to-face coming together of two people who develop a shared purpose. These predictions of course offer as much opportunities as they do risks and will open a new set of therapeutic competencies to both challenge set assumptions about the therapeutic encounter and relationship as it will necessitate to develop a new framework for safe and containing interactions. Core issues of the creation and maintenance of epistemic trust as a basis for social learning as a fundamental psychotherapeutic process will need to be reconceptualized in its facilitation in digitally mediated therapeutic communications. Furthermore, individual's changed social behaviours within online environments will need to be carefully examined and considered in their potential impact on psychotherapeutic practice.

Digitally-mediated communication can have an enormous impact on empowering vulnerable individuals. For example, the internet has enabled people in dangerous situations (e.g. journalists, abuse victims) to directly message for help (Hession, 2016). Furthermore, virtual reality therapies are already negating the need for face-to-face psychological input. In their latest development, Freeman and colleagues (2018) have automated psychological therapy for people with a fear of heights using immersive virtual reality technology by way of an avatar virtual coach, animated using motion and voice capture of an actor. These therapies have the potential for scalable with the potential to overcome access problems currently observed in mental healthcare delivery. Clearly, such advancements and developments in psychotherapy practice, as they become more common place, will impact on psychotherapy input as we currently know it. However, qualitative work undertaken

by our group has shown that staff in particular are wary about the potential for DHIs more specifically to replace traditional face-to-face support. As the evidence base underpinning DHIs is promising and very much still in its infancy, it remains unknown as to whether digital tools will in fact replace, at least to some extent, face-to-face care as they move out of clinical trial. Given staff concerns about the role technology will play in mental healthcare, namely digital technologies might replace the workforce, the success by which these technologies become embedded into routine care is a challenge. Continued communication and input with mental health care staff throughout the development and delivery process is vital when considering the impact digital approaches will undoubtedly have on psychotherapy practice. At this stage, we have raised more questions than we have provided answers. Nevertheless, we have provided examples of digital tools that are being developed and used in the secondary setting and identified a number of challenges that require careful consideration.

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Table 1. Summary of Benefits /Concerns about digital health technologies

Benefits	Concerns
Information Sharing	Abundance of unregulated material
<ul style="list-style-type: none"> Self-initiated psycho-education about problems/difficulties 	Overwhelmed with amount of information available
<ul style="list-style-type: none"> Advice/help for mental health (and related) problems 	Quality of information available (i.e. potentially inaccurate, confusing, misleading information)
<ul style="list-style-type: none"> Aid understanding of own experiences/difficulties (e.g. medication, side-effects, diagnosis) 	Potential to engage in harmful behaviours (e.g. purchasing medication online)
Connection via social media platforms	Potential for ICT systems to fail
<ul style="list-style-type: none"> Opportunity for social referencing (e.g. de-shaming, opportunity for social linking) 	Staff attitudes not evolving at the pace of technological advancements, thereby impacting on uptake and implementation
<ul style="list-style-type: none"> Virtual networks of supportive groups not limited by location or time (far-reaching) 	Perceived loss of therapeutic relationship
<ul style="list-style-type: none"> Reach out and seek support, especially when isolated or person reluctant to seek face-to-face support) 	Ability to identify and manage risk
<ul style="list-style-type: none"> Ability to access motivational content (e.g. view experiences of others offers hopes for future recovery) 	Reliable internet access
Opportunities for Peer Support	Digital literacy skill (both staff and service users) requirements
Choice about healthcare	Safe, secure and trustworthy handling of data (e.g. potential for exploiting disability payments)
Anonymity	Safe data storage
Facilitates ease of access and timely access (i.e. unconstrained by time and place) in a comfortable and familiar (online) environment	Inferior (Cheap) replacement for face-to-face support (cost-cutting exercise)
Low cost	Disengagement due to lack of face-to-face contact
Secure, easy and timely data sharing between providers	
Potential avenue for future contact if person disengages from services	
De-stigmatising / normalising (as digital technologies become more ubiquitous)	

