Blended human-technology service realities in healthcare

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Abstract

Purpose – The healthcare sector is experiencing a major paradigm shift toward a people-centered approach. The key issue with transitioning to a people-centered approach is a lack of understanding of the ever-increasing role of technology in blended human-technology healthcare interactions and the impacts on healthcare actors' well-being. The purpose of the paper is to identify the key mechanisms and influencing factors through which blended service realities affect engaged actors' well-being in a healthcare context.

Design/methodology/approach – This conceptual paper takes a human-centric perspective and a value co-creation lens and uses theory synthesis and adaptation to investigate blended human-technology service realities in healthcare services.

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Findings – The authors conceptualize three blended human-technology service realities – human-dominant, balanced and technology-dominant – and identify two key mechanisms – shared control and emotional-social and cognitive complexity – and three influencing factors – meaningful human-technology experiences, agency and DART (dialogue, access, risk, transparency) – that affect the well-being outcome of engaged actors in these blended human-technology service realities.
Practical implications – Managerially, the framework provides a useful tool for the design and management of blended human-technology realities. The paper explains how healthcare services should pay attention to management and interventions of different services realities and their impact on engaged actors. Blended human-technology reality examples – telehealth, virtual reality (VR) and service robots in healthcare – are used to support and contextualize the study's conceptual work. A future research agenda is provided.
Originality/value – This study contributes to service literature by developing a new conceptual framework that underpins the mechanisms and factors that influence the relationships between blended human-technology service realities and engaged actors' well-being.

Keywords Blended human-technology service realities, People-centered healthcare, Shared control, DART, Well-being, Service robot, Covid-19

Paper type Research paper

Introduction

People-centered healthcare is a vision advocated by the World Health Organization (WHO) that is evolving from being centralized and sequential to being distributed and open, where healthcare professionals share power and have a bilateral exchange of knowledge, information and decision-making in their interactions with healthcare consumers (Lukersmith *et al.*, 2016; Nimmon and Stenfors-Hayes, 2016; WHO, 2018). A people-centered healthcare (human centric) approach strives to improve the quality of interactions between healthcare consumers and healthcare services by placing the consumer at the center of decision-making for all aspects that influence their well-being (Anderson *et al.*, 2018). These service interactions between engaged actors are increasingly facilitated by digital technology in various degrees. Furthermore, technology has the capacity to allow shared decision-making in human-centric healthcare practices, enabling value co-creation and ultimately well-being, among the various actors within the healthcare system, particularly the dyadic relationship between healthcare consumer and professional (see Chen *et al.*, 2020; McColl-Kennedy *et al.*, 2012; Osei-Frimpong *et al.*, 2015; Riotta and Bruccoleri, 2021).

The importance of technology is evident in people-centered healthcare (Lukersmith *et al.*, 2016). Technology is essential not only because it makes consumer participation possible but at the same time demands consumers to engage in different human-technology service realities (Hu *et al.*, 2019). The irruption introduced by eHealth, IT and the "amazonification" of healthcare is already having a major impact on the healthcare of individuals and populations (Desjardins, 2018). Specifically, healthcare service interactions are now taking place in various situations and settings, involving different levels of human interaction and digital health technology (Shore, 2020). The trend of blended human interaction and technology (human-technology interactions), from telehealth to the use of virtual reality (VR) in a healthcare consultation, is being touted as the future of healthcare with multiple realities (Hu *et al.*, 2019; Singh *et al.*, 2017). The escalating need for healthcare services to implement technology and digital tools (Lukersmith *et al.*, 2016; Masucci *et al.*, 2021) prompts us to investigate the relationship between the human-technology service realities and engaged actors' well-being.

The healthcare sector is embracing blended human-technology service realities hastened by the COVID-19 pandemic (Sust *et al.*, 2020) and the uncertainty and opportunity associated with digital transformation (Huang and Rust, 2017). The global pandemic crisis has redefined people's lives and the way services engage and operate, with governments, healthcare providers and professionals rapidly adopting digital technology to continue delivering their services (Karpen and Conduit, 2020; Salvador-Carulla *et al.*, 2020). Even prior to the crisis the

service context was changing, with advancements in technology impacting service delivery and design (Ostrom *et al.*, 2015; Rust and Huang, 2014; Wünderlich *et al.*, 2015), service innovation (Gustafsson *et al.*, 2020) and consumers engagement with smart devices (Wittkowski *et al.*, 2020). Despite the escalating need for healthcare services to implement technology and digital tools, compounded with improvements in technology, the conceptualization of blended human-technology service realities remains vague and undefined. Additionally, these service realities are challenged by the imbalance of power between healthcare professionals and consumers (Bolden *et al.*, 2019) and potential adoption due to their emotional-social and cognitive complexity (Wirtz *et al.*, 2018).

Despite scant literature that postulates blended human-technology service realities, scholars have called for (1) better understanding of the ever-increasing role of technology in healthcare interactions (Finsterwalder and Kuppelwieser, 2020; Masucci *et al.*, 2021) and (2) developing useful conceptual frameworks that consider the changing roles of technology, service providers and customers (Larivière *et al.*, 2017; Robinson *et al.*, 2020; van Doorn *et al.*, 2017). Hence, research is required to conceptualize blended human-technology service realities and develop new human-centric frameworks to help understand the factors that influence engaged actors' well-being in such service realities (Larivière *et al.*, 2017; Katapally, 2020). A human-centric approach recognizes the necessity to co-create well-being whereby all engaged actors contribute to the well-being of the healthcare consumers (Chen *et al.*, 2018, 2020; McColl-Kennedy *et al.*, 2017). The purpose of this paper is to identify the key mechanisms and influencing factors through which blended service realities affect engaged actors' well-being in a healthcare context. We define mechanisms as the key factors through which two variables are related (i.e. mediating factors; see Harmeling *et al.*, 2017 for examples). Influencing factors are the aspects that strengthen or weaken this relationship. Specifically, this research takes a human-centric perspective and value co-creation lens that considers healthcare consumers as active participants with healthcare professionals and health technologies, and pose the following research question: What are the key mechanisms and influencing factors that enhance engaged actors' well-being involved in blended human-technology service realities?

We adopt Jaakkola's (2020) conceptual research design and utilize theory synthesis and theory adaptation by carrying out an extensive literature search to find relevant concepts and theories to answer the research question. In doing so, we begin our examination within services literature to explore the use of technology in the service environment and to understand the role of technology in various service realities. Given our healthcare context, we then investigate healthcare literature and service literature with a healthcare focus. Finally, we apply theory adaptation (Jaakkola, 2020) and extend healthcare service literature by developing a conceptual framework that explains how actors' well-being is achieved within various blended human-technology service realities.

In this paper, we develop a blended human-technology service realities conceptual framework, and in doing so make three key contributions. First, we address the call to better understand the ever-increasing role of technology in healthcare interactions by offering a continuum and typology of blended human-technology service realities – human-dominant, balanced and technology-dominant – built on service reality literature (Flavian *et al.*, 2019; Bower *et al.*, 2017). Second, considering the increasing interactions of technology between service providers and customers, we propose a conceptual framework that underpins the relationship between blended human-technology service realities and engaged actors' well-being in healthcare services. We propose two key mechanisms (shared control and emotional-social and cognitive complexity) to advance understanding on how healthcare consumers engage in healthcare services (Danaher and Gallan, 2016) and extend work on technology in services (Lariviére *et al.*, 2017; Ramasamy and Ozcan, 2018; Wirtz *et al.*, 2018). Third, we build on value co-creation in healthcare literature (McColl-Kennedy *et al.*, 2012, 2016; Sweeney *et al.*,

2015) and introduce three key influencing factors, namely agency, human-technology meaningful interactions and DART (dialogue, access, risk and transparency), that influence the well-being of engaged actors in human-technology service realities.

The paper is organized as follows. We start with a literature review on human and technology interactions in healthcare services. Then, we conceptualize blended human-technology service realities by identifying and conceptualizing three realities – human-dominant, technology-dominant and balanced. This background literature and conceptualization provides us with the foundation to develop our blended human-technology service reality conceptual framework. Following this, we propose our framework and methodically explain the constructs and relationships of the framework. We then discuss three examples of each of the three blended human-technology realities. Lastly, we discuss the theoretical and managerial implications and provide a future research agenda.

Human and technology interaction in healthcare services

Human interaction in healthcare services

Human interaction in healthcare services has received considerable attention in both medical and service literature (Adams *et al.*, 2016; McColl-Kennedy *et al.*, 2017). The healthcare professional-consumer relationship has long been described "as the keystone of care" which leads to "optimum health outcomes" (Adams *et al.*, 2012, p. 127). Healthcare professionals need to establish relationships with their customers, and this can be done through effective practice (McColl-Kennedy *et al.*, 2012). Healthcare professionals with a person-focused interaction style who involve the healthcare consumer in shared decision-making have been linked to higher reported quality of care (Coulter, 2012). Shared decision-making, involving shared control, can lead to treatment choices that improve health outcomes for healthcare consumers (Hardyman *et al.*, 2015; Lukersmith *et al.*, 2016).

Shared control can also enable consumer engagement, information exchange and communication of shared values between healthcare professional and consumer, promotion of health service literacy and consumer ownership of treatment decisions (Davey and Grönroos, 2019; Shih *et al.*, 2018). As a result, shared control and establishing positive long-term relationships between healthcare consumers and professionals can be further enhanced through co-creating value to achieve mutualistic and "positive partnerships" leading to improved well-being (Cegala *et al.*, 2012; McColl-Kennedy *et al.*, 2012; Tibaldi *et al.*, 2011). In this sense, value co-creation is an important consideration in human-centric healthcare, whereby healthcare consumers take an active role and participate during healthcare interactions, and healthcare professionals enable value co-creation through practice styles with open dialogue that are transparent and reduce asymmetry of knowledge (Frow *et al.*, 2016; McColl-Kennedy *et al.*, 2012, 2016, 2017). We adopt the view that value co-creation in a healthcare context is the collaborative interactions and activities between consumers, healthcare professionals and other engaged actors that are essential to enhancing engaged actors' well-being (Chen *et al.*, 2020; Oertzen *et al.*, 2018; Sweeney *et al.*, 2015).

However, an imbalance of power between healthcare professionals and consumers, because of the asymmetry of medical knowledge, can exacerbate the breakdown in healthcare relationships, potentially leading to value destruction and hindering health and well-being outcomes (Bolden *et al.*, 2019; Lu *et al.*, 2018; Makkonen and Alkkonen, 2017). Healthcare professionals believing in their authority to interpret the suitability of healthcare consumers' decision-making can often feel empowered or constrained when practicing people-centered care (Lukersmith *et al.*, 2016). Such challenges could be managed through digital health technologies which enable healthcare consumers to self-care (Tian *et al.*, 2014; Zainuddin *et al.*, 2016) and participate in their healthcare (Chu *et al.*, 2018) by increasing their levels of knowledge (Calvillo *et al.*, 2015), providing access to information (Dedding *et al.*, 2011) and enhancing communication between consumer and healthcare professional (Smailhodzic *et al.*, 2016).

Digital technology in healthcare services

Digital health technologies can be empowering, facilitate shared decision-making and balance healthcare professional-consumer power structures (Chu *et al.*, 2018; Lundmark and Evaldsson, 2017). For example, from a healthcare professional's perspective, interactive digital health platforms that generate an aggregated view of real-time data through dashboards, data visualizations and targeted reports can offer an effective means of reviewing healthcare consumer's data (Granja *et al.*, 2018). The use of predetermined criteria to alert the healthcare professional if healthcare consumers experiences health complaints outside of the practice can facilitate efficient intervention and, in some cases, even save lives (Chu *et al.*, 2018). For example, digital health platforms that record and send health data to healthcare professionals, such as pacemaker heart monitors and smartphone apps that record movement and sleep patterns, can help monitor a healthcare consumer's health (Ramaswamy and Ozcan, 2018).

From a healthcare consumer's perspective, health technologies can increase knowledge, allowing more informed decisions, improving compliance, reducing anxiety levels and co-creating value by participating actively in the treatment and treatment decisions (Calvillo *et al.*, 2015; McColl-Kennedy *et al.*, 2017). The use of digital health platforms that promote privacy and anonymity was also considered an enabler and helped empower consumers to use healthcare services (Lundmark and Evaldsson, 2017). The use of self-care technologies such as wearables and digital platforms (Apps) that monitor health can support a healthcare consumer's value self-creation by encouraging the consumer to manage their own health data by providing them with relevant information and treatment recommendations (Zainuddin *et al.*, 2016).

Despite research supporting the use of digital technology to shape a model of people-centered care, digital health technologies have also been shown to inhibit healthcare consumer agency and engagement with healthcare professionals and services (Tian *et al.*, 2014). The potential downsides of digital technology are the dehumanization and loss of identity through the reduction of face-to-face interactions (Tian *et al.*, 2014), and disempowerment due to lack of capacity, user anxiety, digital divide and information overload (Andersen *et al.*, 2019). When technologies failed to work as expected, people are left feeling frustrated, leading them to become disillusioned with digital health technology (Lupton and Maslen, 2019). Although a sense of agency can be heighted with, for example, health apps, there is a balance with the benefits and the actual demands often made by the digital technologies themselves (Trnka, 2016). Some healthcare professionals see digital health technologies as a threat to their traditional roles, power relationships and sense of professional agency (Broom, 2005). There has been an increase in disturbing healthcare consumer-professional relations, or a demand on more intense healthcare consumer participation due to a shift in power structures (Dedding *et al.*, 2011). This double-sided nature of health technology indicates that service provider's and consumer's reactions to the use of technology in service interactions often depend on the emotional-social and cognitive complexity of the service environment (Wirtz *et al.*, 2018).

Human-technology interaction

Service interactions considering blended human interaction and technology are being plugged as the future of healthcare (Hu *et al.*, 2019). Therefore, understanding how human and technology interactions in healthcare services achieve well-being is crucial (McColl-Kennedy *et al.*, 2017). In concert with the rise in calls for technology use, there are increasing calls for healthcare services to preserve human presence and ensure compassion is safeguarded (Brown, 2019). While there are numerous articles in healthcare espousing the benefits of either technology (see, for example, Chu *et al.*, 2018; Lundmark and Evaldsson, 2017; Tian *et al.*, 2014) or human interaction (see, for example, Adams *et al.*, 2016; Coulter, 2012; Theofilou, 2011),

there are limited frameworks that address how these two approaches can be blended. Our study addresses this need to better understand such blended human-technology service realities. Firstly, we offer a conceptualization of blended human-technology service realities discussed in the next section and then propose a framework explaining the mechanisms and factors that support the relationships between these blended human-technology service realities and engaged actors' well-being.

Conceptualization of blended human-technology service realities

There is a lack of coherence with different terminology being used in various contexts to explain the various human-technology realities (Flavian *et al.*, 2019). Referred to as a blended approach in education (Hockley, 2018), hybrid approach in healthcare (Chan *et al.*, 2014; Shore, 2020) and either blended, hybrid or mixed reality in gaming, IT and services marketing (Bower *et al.*, 2017; Flavian *et al.*, 2019; Seo *et al.*, 2016), there is little consistency with the use of the terms. Table 1 provides an overview of the terms and contexts.

The terms to describe human-technology realities are often conceptually overlapping. For example, in service marketing, Flavian *et al.* (2019) outline a reality-virtuality continuum that ranges from the real environment to the virtual environment, with mixed reality consisting of virtual and augmented reality (VR/AR) and augmented reality and augmented virtuality (AR/AV). In an education context, Bower *et al.* (2017) created a physical-virtual continuum spanning the physical environment, blended reality and virtual environment. In technology literature, the term hybrid reality is used (Seo *et al.*, 2016; Sifonis, 2019). Furthermore, various reality terms are used to describe types of reality environments such as augmented reality (AR), augmented virtuality (AV) and virtual reality (VR).

Based on the reality-virtuality continuums developed by Flavian *et al.* (2019) and Bower *et al.* (2017), we propose a service realities continuum (Figure 1) that anchors on physical reality at one end and virtual reality at the other end. Physical reality is characterized by pure human interaction in a real environment and involves interactions where consumers interact solely with elements of the physical world with minimum aid of information communication technology (Seo *et al.*, 2016). In contrast, virtual reality is characterized by pure technology and represents the digitalized interactions without the need for human physical presence (Ramaswamy and Ozcan, 2018).

Our research focuses on the *blended human-technology service realities* that lie between the two ends of physical reality and virtual reality and accounts for the role of both human interaction and technology. The *blended human-technology service realities* consist of the varying combinations of human and technology realities that can be experienced in a service setting. The human and technology combination can be human-dominant, technology-dominant or balanced. We introduce the new terms of *human-dominant reality* and *technology-dominant reality* to represent service interactions, with different emphasis on human interaction and technology. *Human-dominant reality* signifies that the interaction is mostly human-driven and delivered, whereas *technology-dominant reality* relates to interactions and environments that are mostly technology-driven and delivered. *Balanced reality* represents a relatively even balance of human interaction and technology, whereby consumers experience elements of the physical world and technology/digital content is integrated into their surroundings, enabling them to interact with both digital and real contents (Flavian *et al.*, 2019).

Typology of blended human-technology service realities in healthcare

To elaborate further on each of the three *blended human-technology service realities*, we develop a typology (Table 2) that provides specific detail on what each reality entails in terms of the level of human interaction, perceived risk, technology engagement and sophistication of the technology. It is important to note that the context of each blended human-technology

Term	Definition	Context	Source publication
Approaches			
Blended approach	Incorporates face-to-face with digital (online) interactions	Education	Hockley (2018)
Blended care/ therapy	New approach combining face-to-face therapy and the Internet and mobile-based interventions	Healthcare	Baumeister *et al.* (2020)
Hybrid approach	Variety of media is used for communication including face-to-face, text messaging, static visual, video conferencing, web-based healthcare consumer portals and social networks Combining person and online strategies	Healthcare	Shore (2020), Chan *et al.* (2014)
Reality environments and specific reality technology			
Physical reality	Where users interact solely with elements of the real world	General	Seo *et al.* (2016)
Augmented reality (AR)	Allows the user to interact with the real world, with virtual objects and support systems superimposed upon or composited with the real world Combination of the real and virtual environment	General	Seo *et al.* (2016), Hu *et al.* (2019)
Augmented virtuality (AV)	Superimposes real-world elements on virtual environments	General	Flavian *et al.* (2019)
Virtual reality (VR)	Immerses the user inside a virtual and synthetic environment. While immersed the user cannot see the real world	General	Seo *et al.* (2016)
Combined reality environments			
Blended reality	Environment that brings together participants' augmented reality and augmented virtuality spaces	Education	Bower *et al.* (2017)
Hybrid reality	Combining virtual and augmented reality (VR/AR) with physical reality	Smart homes Gaming	Seo *et al.* (2016), Sifonis (2019)
Mixed reality	Merging of real and virtual environments, whereby users are placed in the real world and digital content is integrated into their surroundings, so they can interact with both digital and real contents	Service marketing Healthcare	Flavian *et al.* (2019), Hu *et al.* (2019)

Table 1.
Terms and definitions of concepts relevant to blended service realities

service reality relates to the level of technology and human interaction in healthcare encounters (i.e. between healthcare consumers and their family/friends, and healthcare professionals).

Taking a human-centric perspective, first, we consider the level of *human interaction*, as the human element is an important aspect of each of the three blended human-technology service realities (Flavian *et al.*, 2019; Letheren *et al.*, 2021) and can determine the degree of emotional-social complexity in each reality (Wirtz *et al.*, 2018). Second, we include levels of *perceived risk associated with trust* in the technology because this often determines adoption behavior (Pavlou, 2003; Wunderlich *et al.*, 2015). Third, we incorporate the varying levels of *technology engagement* identified by Letheren *et al.* (2019) in their study on household engagement of home technologies. The levels include passive technology which is mostly informational; interactive and assistive technology such as Apps where there is human and technology engagement; and proactive technology where the technology mostly engages on behalf of the user. Fourth, we consider the level of *sophistication of the technology* because the varying complexity of these technologies serves as the basis of the human-dominant, balanced and technology-dominant realities. Also, the level of sophistication reflects the

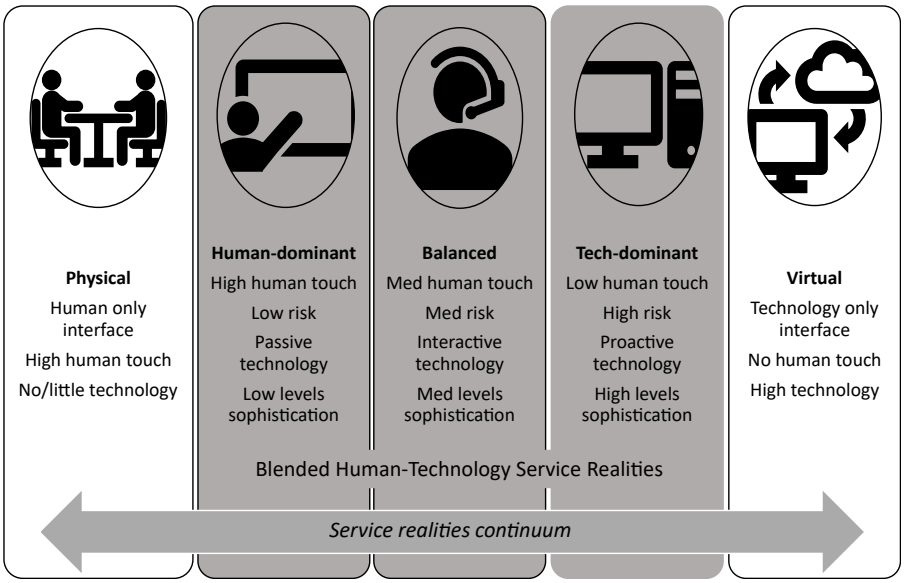

Figure 1.
Service realities continuum

	Human-dominant reality	Balanced reality	Technology-dominant reality
Human service interaction	High human touch	Medium human touch	Low human touch
Perceived risk associated with trust	Low risk comparing to technology-dominant reality	Medium risk comparing to human-dominant and technology-dominant realities	High risk comparing to human-dominant reality
Technology engagement	Passive	Interactive and assistive	Proactive
Technology sophistication	Low	Medium	High
Healthcare examples	Telehealth	Use of VR or AR in healthcare consultations; wearable health apps or devices	AI-enabled service robots

Table 2.
Typology of human-technology service realities

potential adoption of and readiness to embrace the technology itself (Larivière *et al.*, 2017; Parasuraman and Colby, 2015). Together, we provide a typology of human-technology service realities as outlined in Table 2 and then describe the characteristics of each reality.

Human-dominant reality. A human-dominant reality is primarily human-driven, and the technology used is relatively passive. Passive technology is characterized by passive information sharing and is preferred by those who have high perceived risk and low trust in technology (Letheren *et al.*, 2019); therefore, the human-dominant reality is perceived as relatively low risk with high levels of trust in the technology. In this reality, the level of sophistication of the technology is low and human interaction is high, creating a service reality that can respond to complex emotional-social situations but only requires lower levels of cognitive complexity to engage (Wirtz *et al.*, 2018). For example, telehealth from both healthcare professional's and consumer's perspective is relatively low-tech and easy to use. Given the exponential growth of telehealth due to COVID-19, it is now perceived as a high-trust and low-

risk technology (Moss *et al.*, 2020). Furthermore, although telehealth technology facilitates interactivity, it is not interactive in of itself and therefore comparatively passive.

Balanced reality. A balanced reality is where there is a mix of human interaction and technology, whereby the technology is interactive and/or assistive. Interactive and assistive technology is collaborative and user-generated, and generally preferred by those that have moderate levels of perceived risk and trust (Letheren *et al.*, 2019). The technology involved is considered relatively sophisticated, whereby the technology requires some level of cognitive ability to adopt and embrace it (Larivière *et al.*, 2017). For example, technology such as VR or AR is used by the healthcare professional in clinic, such as preoperative communication between healthcare professionals and healthcare consumers, discussions around operation plans and interoperative guidance (Hu *et al.*, 2019). It can also include healthcare professionals providing their customers with health monitors, which both parties can track (e.g. heart, mental health), enabling information sharing between the healthcare professional and consumer (Tian *et al.*, 2014). The use of wearables and digital platforms (Apps) requires a reasonable amount of value self-creation, whereby the healthcare consumer has responsibility for using the device/s (Zainuddin *et al.*, 2016).

Technology-dominant reality. A technology-dominant reality is primarily technology-driven with little human intervention and/or interaction, where the technology is proactive (i.e. adjusts and works automatically on behalf of the user) and highly sophisticated. Proactive technology is still considered high risk and low trust because this type of technology is mostly adopted and preferred by those that either embrace technology and/or are happy to interact/operate with very little human interaction (Letheren *et al.*, 2019). A technology-dominant reality has the potential to revolutionize predictive healthcare and provide more timely and accurate diagnoses (Agarwal *et al.*, 2020). For example, the use artificial intelligence (AI) has enabled healthcare professionals to provide more personalized healthcare and contributed to a shift toward prevention (Agarwal *et al.*, 2020). Technology used in technology-dominant realities is often able to complete tasks that usually require human intelligence by sensing environmental conditions, making decisions or executing commands, for example, AI chatbots and service robots that can collect healthcare consumer's data and suggest the next course of action and automate repetitive processes/tasks, or use of machine-learning technology to make more accurate diagnoses (Čaić *et al.*, 2019; Cuocolo *et al.*, 2019).

Framework for blended human-technology healthcare service realities and propositions

The purpose of this paper is to identify the key mechanisms and influencing factors through which blended service realities affect engaged actors' well-being in a healthcare context. Based on the discussion above and further exploration of the literature, in this section, we develop a human-centric conceptual framework (Figure 2) for blended human-technology

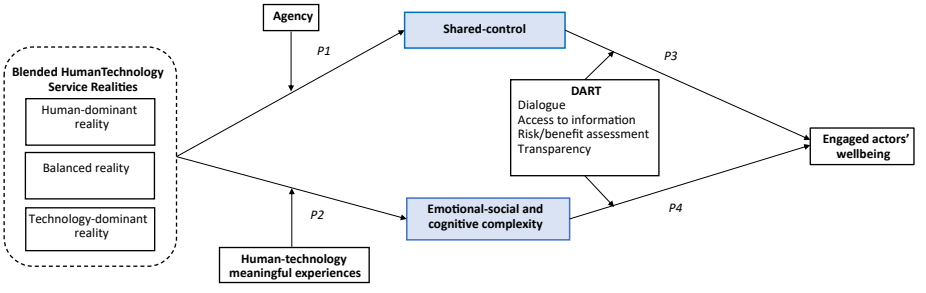

Figure 2.
Blended human-technology service realities framework

service realities and pose four propositions to answer the following research question: What are the key mechanisms and influencing factors that enhance engaged actors' well-being involved in blended human-technology service realities?

The framework is based on the premise that each blended human-technology service reality – human-dominant, balanced and technology-dominant – has the capacity to directly impact the well-being of engaged actors. Each reality has the potential to enhance engaged actors' well-being due to a sense of empowerment and shared decision-making enabled through the blend of human interaction and technology (Chu *et al.*, 2018; Lundmark and Evaldsson, 2017). Conversely, each reality also has the potential to reduce healthcare consumer engagement with healthcare professionals due to lack of capacity, user anxiety, digital divide and information overload, reducing well-being (Andersen *et al.*, 2019; Tian *et al.*, 2014). Therefore, it is critical to understand the mechanisms and influencing factors that can enhance engaged actors' well-being in blended human-technology service realities.

We identify two mechanisms and three influencing factors and explain the relationship between blended human-technology service realities and well-being of engaged actors. Specifically, we establish that blended human-technology service realities affect engaged actors' well-being through two key mechanisms (1) shared control and (2) emotional-social and cognitive complexity. The underlying relationships in the framework are influenced by (1) agency, (2) meaningful human and technology experiences and (3) DART. We now explain the framework and the corresponding propositions.

Shared control as a key mechanism

Shared control is considered the best practice in people-centered healthcare (Lukersmith *et al.*, 2016). As discussed in the literature review section, we argue that shared control during interactions within the healthcare service environment is a key factor leading to enhanced well-being (Gardner and Gibb, 2016). Shared control is where healthcare professionals share power, exchange knowledge and information and advocate shared decision-making in their interactions with healthcare consumers (Nimmon and Stenfors-Hayes, 2016). Shared control can lead to increased satisfaction of the involved actors, more trust, reduced anxiety and improved communication of healthcare professionals, leading to a higher quality of life and well-being for healthcare consumers in the long term (Chen *et al.*, 2020; Shih *et al.*, 2018).

Shared control in healthcare service interactions is being enabled by technology and digital health platforms (Lukersmith *et al.*, 2016). Health technologies, when used in a healthcare service, are thought to enable shared control because they allow healthcare consumers to participate in their healthcare (Chu *et al.*, 2018) by increasing their levels of knowledge (Calvillo *et al.*, 2015), providing access to information (Dedding *et al.*, 2011) and enhancing communication between consumer and healthcare professional (Smailhodzic *et al.*, 2016). Furthermore, research alludes to blended human-technology interactions being empowering, facilitating shared decision-making and balancing healthcare professional-consumer power structures (Chu *et al.*, 2018; Lundmark and Evaldsson, 2017; Tian *et al.*, 2014).

However, the use of technology in healthcare can also have negative impacts. Technology can reduce the power of healthcare consumers by making healthcare services more efficiency-focused and less human-centered, leading to more physical and emotional distance between healthcare consumers, caregivers and healthcare professionals (Anderson *et al.*, 2018). Conversely, technology may also aid the development of an inverse control model, where power is skewed toward the healthcare consumers, who make decisions regardless of healthcare professionals' recommendations (Lukersmith *et al.*, 2016).

To mitigate the negative aspects and to strengthen shared control in blended human-technology realities, we propose that agency can act as a key influencing factor. Given the emphasis on people-centered healthcare and shared-control, agency has become an important concept to understand as it has been associated with improved relationships and well-being outcomes (Paquet *et al.*, 2010). There is evidence that healthcare service interactions can be improved when healthcare professionals and service providers acknowledge and adapt to healthcare consumers' needs, by understanding the uniqueness of an individual's resources and agency (Davey and Grönroos, 2019).

Agency as an influencing factor

The principal-agent theory is particularly relevant to healthcare because of the specific roles and service functions of various actors in healthcare that involve decision-making (Dadich and Doloswala, 2018). In healthcare research, agency theory has been used to understand healthcare professionals and consumer relationships, and tensions between healthcare professionals, their organization and healthcare consumers (Dadich and Doloswala, 2018; Jiang *et al.*, 2012). To illustrate, an agency relationship occurs when a contract (or relationship) between one or more people (the principal/s) engages another person (the agent) to act on behalf, or to carry out some service that involves assigning some decision-making to the agent (Buchanan, 1988; Ross, 1973). There are three broad assumptions fundamental to agency theory: (1) *Agency risks/costs* –healthcare consumer (principal) and healthcare professional (agent) may have different attitudes toward risk. Agency risk exists when there are potential differences in interests between the principal and agent, and when costs of the agent exceeds the benefits obtained by the principal. (2) *Efficiencies* – efficiency is the means of achieving the greatest reduction of risk and improved outcomes in the most effective way (Buchanan, 1988). Efficiencies are critical and are often associated with reduced quality; however, efficiency and quality have been found to improve simultaneously because quality healthcare services reduce errors, mitigate information asymmetry and foster relationships enabling better outcomes (Ludwig *et al.*, 2010). (3) *Information asymmetry* – it is based on the assumption that at any point in the healthcare consumer-professional (principal-agent) relationship, there can be an information-advantage or disadvantage for either party (Bosse and Phillips, 2016; Jiang *et al.*, 2012). Therefore, we posit that agency (reducing risk, enhancing efficiencies and reducing information asymmetry) can help facilitate shared control in blended human-technology service realities.

We propose that shared control is a key mechanism that affects the relationship between blended human-technology service realities (human-dominant, balanced, tech-dominant) and engaged actors' well-being, and this is strengthened by an agency relationship, leading to proposition 1 (P1):

P1. Engaged actors' experiences of shared control throughout interactions in blended human-technology service realities (human-dominant, balanced, technology-dominant) affect well-being outcomes. This relationship can be positively influenced through meaningful human-technology experiences.

Emotional-social and cognitive complexity as a key mechanism

Based on the service realities and human-technology literature discussed previously, we identified that the level of emotional-social and cognitive complexity (Wirtz *et al.*, 2018) is a key factor that determines how well-being of engaged actors is potentially achieved. Fundamentally, in blended human-technology service realities, how healthcare professionals and consumers respond to the emotional-social and cognitive complexity of the reality in terms of skills and acceptance can either facilitate or inhibit actors' well-being. Emotional-social

complexity refers to the extent that social presence, human engagement and psychological comfort are required in the interaction. Cognitive complexity is the level of analysis and/or problem solving that is needed in the interaction (Wirtz *et al.*, 2018). How service providers and customers react to various blends of human-technology service realities depends on the emotional-social and cognitive complexity of each service environment, including the level of technology in each and "readiness" of the actors involved to perform emotional and cognitive tasks (Lariviére *et al.*, 2017).

To illustrate, a relatively *complex emotional-social and complex cognitive* service reality, such as the use of VR in a preoperative clinical consultation, needs the healthcare professional to have both emotional-social and cognitive skills to deliver and requires the healthcare consumer to have the emotional-social and cognitive ability to engage. If both parties are emotionally, socially and cognitively competent, then the interaction can enhance engagement, information exchange, communication and involvement in treatment decisions (Chu *et al.*, 2018; Dedding *et al.*, 2011; Lundmark and Evaldsson, 2017; Tian *et al.*, 2014; Shih *et al.*, 2018). Otherwise, this situation could lead to frustrations with digital technologies (Lupton and Maslen, 2019; Trnka, 2016). Whereas a *simple emotional-social and complex cognitive* service reality, such as the healthcare professionals' use of automatic medical transcribing that uses AI, requires very little emotional/social skills but needs reasonable cognitive skills. In contrast, a *complex emotional-social and simple cognitive* service reality, such as the use of telehealth technology, is primarily emotional-social-driven requiring a high level of social interaction and engagement but is relatively easy to operate and perform for both the healthcare professional and customer (Asiri *et al.*, 2018; Moss *et al.*, 2020). Lastly, *simple emotional-social and simple cognitive* service reality, such as booking appointments online and accessing information from healthcare service website, requires relatively little emotional and cognitive ability (for most people) in terms of tasks and yet can assist in providing access to information (Dedding *et al.*, 2011) and enhancing consumer and healthcare professional relationships (Smailhodzic *et al.*, 2016).

Meaningful human-technology experiences as an influencing factor

The influencing factor affecting the perceived emotional-social and cognitive complexity of the human-technology service realities is how meaningful are the human-technology interactions experienced by the healthcare consumer (Mekler and Hornbaek, 2019). Human-computer interaction (HCI) is influenced by how people respond to the technology being used, and the elements required to ensure meaningful experiences (Mekler and Hornbaek, 2019). It focuses on users' experiences of technology; it has evolved to look beyond the instrument (technology) itself and considers aspects of the interaction such as emotions, transparency and useability (Hassenzahl and Tractinsky, 2006). The underlying meaning and purpose of the users' experience with HCIs is thought to enhance human-technology interactions (Mekler and Hornbaek, 2019). They identify five distinct elements supporting meaningful human-technology experiences, including connectedness, purpose, coherence, resonance and significance. *Connectedness* refers to the technology enabling a user to feel connected and/or have personal connections. *Purpose* highlights the importance of the human-technology interaction in terms of providing "a sense of direction" and clear goals and is often the motivational element. *Coherence* relates to the degree to which a person's experiences makes sense and results from considering and understanding those experiences. *Resonance* denotes the idea that the experience is a good fit and feels right. *Significance* is about a person having a sense that their experiences matter and are of value (Mekler and Hornbaek, 2019).

We understand that healthcare professionals' and customers' reactions to various blends of human-technology service realities depend on the emotional-social and cognitive complexity of each service reality in terms of the level of technology in each and the preparedness of the actors involved in performing emotional and cognitive tasks (Lariviére *et al.*, 2017).

We also appreciate that the underlying meaning and purpose of a healthcare consumers' experience with each blended service reality is thought to enhance human-technology interactions (Mekler and Hornbaek, 2019). Therefore, we propose that the emotional-social and cognitive complexity toward blended human-technology service realities is an important mechanism that is positively influenced by meaningful human-technology experiences, leading to proposition 2 (P2):

P2. Engaged actors' responses to various levels of emotional-social and cognitive complexity in blended human-technology service realities (human-dominant, balanced, technology-dominant) affects well-being outcomes. This relationship can be positively influenced through meaningful human-technology experiences.

DART as an influencing factor

As previously discussed in the literature, value co-creation is essential in healthcare interactions and can lead to enhanced well-being outcomes (Danaher and Gallan, 2016; McColl-Kennedy *et al.*, 2012, 2016; Oertzen *et al.*, 2018; Sweeney *et al.*, 2015; Zainuddin *et al.*, 2016). Given healthcare is now increasingly grounded in advances in technology, clear dialogue and access in human-technology service realities is critical to reducing information asymmetry and enabling transparency in healthcare interactions (Lukersmith *et al.*, 2016; Masucci *et al.*, 2021). Therefore, we argue that Prahalad and Ramaswamy's (2004a) DART is an important construct in the context of blended human-technology service realities. Genuinely integrating these four building blocks of interaction, as antecedents of value co-creation, is essential to ensuring shared control (Farrington, 2016; Ocloo and Matthews, 2016) and the response to the emotional-social and cognitive complexity of the realities positively impacts engaged actors' well-being. Each element of the DART framework is now outlined in relation to its application in healthcare services.

Dialogue encompasses the active interaction and engagement between actors (Prahalad and Ramaswamy, 2004b; McColl-Kennedy *et al.*, 2012). Dialogue involves active communication and integration of different knowledge bases (Prahalad and Ramaswamy, 2004b). For example, when a healthcare consumer actively seeks and shares information from other sources with their healthcare professional and the healthcare professional integrates this knowledge, shared decision-making is built on each other's knowledge base (Lukersmith *et al.*, 2016; McColl-Kennedy *et al.*, 2012). This multidirectional exchange of knowledge and information underlying value co-creation positively influences shared control in healthcare interactions by ensuring all actors are engaged (Lukersmith *et al.*, 2016).

Access (to information) considers the availability and understandability of information, methods and tools (Jiang *et al.*, 2012; Prahalad and Ramaswamy, 2004b). This is especially important in a healthcare setting, which is traditionally characterized by an asymmetry of medical knowledge (Lukersmith *et al.*, 2016; Jiang *et al.*, 2012). Anderson *et al.* (2018) suggest that healthcare consumers rarely challenge the recommendations provided by healthcare professionals. However, healthcare consumers are increasingly making use of the Internet and new technologies to become more informed, reducing the opaqueness surrounding medical knowledge and technical jargon (Hu *et al.*, 2019). In turn, access to information empowers healthcare consumers to share control because knowledge is shared between healthcare consumers and healthcare professionals (Lukersmith *et al.*, 2016), creating positive long-term relationships based on cooperation, good communication, choice and shared decision-making (Adams *et al.*, 2012).

Risk-benefits involve the assessment of the benefits assessed against the risks of a particular action (Prahalad and Ramaswamy, 2004a, b). For healthcare consumers to provide informed consent on a proposed treatment plan, they need to be deliberately and granularly informed on the potential benefits and risks of their treatment options (Murray, 2012).

For example, in preoperative care for heart surgery, the healthcare professional provides full details of the risks and benefits of surgery, ensuring the healthcare consumer understands and gives their consent. Technology can enhance this through the use of VR (Hu *et al.*, 2019), enabling shared decision-making, which, in turn, can lead to increased satisfaction and trust of the involved actors (Shih *et al.*, 2018). The ability for all actors engaged to clearly assess the risk-benefit increases shared control because "psychological ownership" of the healthcare consumer's health and well-being is shared (Chen *et al.*, 2020).

Transparency is critical for quality of care and has been found to improve efficiencies and quality simultaneously because quality healthcare services reduce errors, mitigate information asymmetry and foster relationships enabling better outcomes (Ludwig *et al.*, 2010). Transparent communication between healthcare professionals and consumers, whereby a healthcare professional communicates expectations, explains what actions are being taken and translates medical jargon, has been shown to aid shared decision-making and relationship development, increasing shared control (Lukersmith *et al.*, 2016; Robins *et al.*, 2011). Due to advances in technology, information has become more available to consumers, who are now increasingly demanding transparency, helping toward improved outcomes in an efficient way (Ludwig *et al.*, 2010).

Shared control influenced by DART on engaged actors' well-being. Value co-creation, through the implementation of DART, is critical as it enables mutualistic relationships by reducing the imbalance of power between healthcare professionals and healthcare consumers (Tibaldi *et al.*, 2011; Bolden *et al.*, 2019; Lukersmith *et al.*, 2016). The use of DART can encourage healthcare professionals/services and consumers to engage in information exchange, communicate shared values and facilitate value co-creation in treatment decisions (Coulter, 2012; Shih *et al.*, 2018). Further, dialogue and transparency can help reduce agency risk, enhance efficiencies and discourage information asymmetries through cooperation, good communication, choice and shared decision-making (Adams *et al.*, 2012; Cegala *et al.*, 2012; Tibaldi *et al.*, 2011). Without implementing the elements of DART, a healthcare consumers' access, communication and shared decision-making in blended human-technology service realities are potentially inhibited (Bhatt and Chakraborty, 2021).

The asymmetry of medical knowledge between healthcare professionals and consumers is predominantly the reason why there are still miscommunications in healthcare relationships (Lu *et al.*, 2018). Shared control requires the exchange of knowledge and information and decision-making (Shih *et al.*, 2018) and behaviors as outlined by DART to ultimately affect the well-being of engaged actors. By empowering consumers to engage and take ownership of their experiences (Ocloo and Matthews, 2016), DART reinforces shared control in healthcare service interactions that thrives on shared decision-making (Lukersmith *et al.*, 2016). Therefore, we propose that DART influences the relationship between shared control, a key mechanism in human-technology service realities, and actor well-being, leading to proposition 3 (P3):

P3. DART (dialogue, access, risk, and transparency) influences engaged actors' experiences of shared control throughout interactions in human-technology service realities, impacting the well-being of engaged actors.

Emotional-social and cognitive complexity influenced by DART on engaged actors' well-being. Blended human-technology service realities could create tensions between healthcare professionals and consumers, particularly when there are perceived agency risks and asymmetries of information (Bolden *et al.*, 2019; Lukersmith *et al.*, 2016). Such tensions can contribute to how healthcare consumers respond to the emotional-social and cognitive complexity of blended human-technology service realities (Wirtz *et al.*, 2018; Huang and Rust, 2018; Lariviére *et al.*, 2017). For example, due to the *cognitive complexity* in technology-dominant realities, this could have a detrimental effect on engaged actors' well-being through the reduction of meaningful dialogue, lack of transparency and increased agency risks,

because of the loss of identity (Broom, 2005; Tian *et al.*, 2014), digital divide and information overload (Andersen *et al.*, 2019) and frustrations and demands with digital technologies (Lupton and Maslen, 2019; Trnka, 2016).

Further, the implementation of value co-creation activities and practices in healthcare services can lead to increased satisfaction, more trust, reduced anxiety and improved communication, enhancing engaged actors' well-being (Sweeney *et al.*, 2015). Hence, healthcare professionals that focus on value co-creation activities and practices, such as DART, have the potential to mitigate emotional-social and cognitive complexity and, in turn, positively impact engaged actors' well-being (McColl-Kennedy *et al.*, 2017). Therefore, we propose that the emotional-social and cognitive complexity of service interactions would be influenced by DART and result in enhanced well-being, leading to proposition 4 (P4):

P4. DART (dialogue, access, risk, and transparency) influences engaged actors' response to the emotional-social and cognitive complexity in human-technology service realities, impacting the well-being of engaged actors.

In sum, the blended human-technology service realities framework and four propositions elucidate the mechanisms and factors and their impacts on well-being of engaged actors involved in human-dominant, technology-dominant and/or balanced realities. In the next section, we discuss specific examples of each human-technology service reality in our framework to demonstrate.

Blended human-technology service realities in healthcare examples

To highlight the key differences and to demonstrate how our framework and propositions can be applied to each specific human-technology service reality, we discuss the following examples.

Human-dominant reality – telehealth

Telehealth adopted by healthcare professionals to achieve well-being outcomes is a primary example of a human-dominant reality, whereby human interaction is high but the level of sophistication of the technology is relatively low. The use of telehealth has exploded due to the pandemic and is now a common technology used in various healthcare settings (Moss *et al.*, 2020).

Telehealth technology could offer a meaningful human-technology experience that enables complex emotional-social interactions but is relatively simple in terms of cognitive complexity (P2). Therefore, the use of telehealth can help to leverage some of the enablers of technology, in particular, access and continuity of care, while maintaining strong human interactions through dialogue and transparency (Moss *et al.*, 2020), leading to enhanced well-being (P4). Telehealth can also mitigate some of the possible inhibitors of human interaction by making the interaction more accessible and less intimidating, thereby reducing power loss and enhancing communication and connectivity (Asiri *et al.*, 2018) enabling shared control (P1) and leading to enhanced well-being outcomes (Lukersmith *et al.*, 2016). Not only can telehealth enable shared control between healthcare professional and consumer, but it can enhance well-being outcomes by supporting co-creative dialogue and reducing risk (P3). A human-dominant service reality, managed well, will utilize the strengths of human interaction, while using technology to facilitate this service interaction.

Balanced reality – the use of VR in a face-to-face healthcare interaction

The use of VR in face-to-face healthcare interactions to achieve well-being outcomes is an example of balanced reality due to the mix of human interaction and technology, where neither dominate and the technology is typically interactive and/or assistive. For example, the

use of VR technology in a preoperative consultation has shown to enhance communication, reduce asymmetry of information between healthcare professionals and consumers, reduce risk and increase involvement in treatment decisions enabling shared control (P1) (Hu *et al.*, 2019). Shared control in this balanced reality is strengthened through the healthcare consumer gaining access to more information about the surgery and having the risk and benefits clearly shown through the VR by the healthcare professional, leading to enhanced well-being (P3). This relatively complex emotional-social and cognitive service reality (P2) allows social interaction and emotional concerns about the treatment to be discussed and has the ability to enable relatively complex information (e.g. complex heart surgery) to be conveyed (Lariviére *et al.*, 2017). The technology in this instance is meaningful because it helps the healthcare professional explain the condition and treatment plan to both the healthcare consumer and their family, reducing miscommunication and improving well-being (P4).

Technology-dominant reality – service robots

Service robots are a prime example of technology-dominant reality adopted by healthcare service providers to achieve well-being outcomes. Service robots are an emerging technology in services *per se*, but particularly in healthcare services (Čaić *et al.*, 2019; Letheren *et al.*, 2021; Wirtz *et al.*, 2018). Service robots require little human interaction, and the technology is highly sophisticated and proactive. This type of technology can help to leverage shared control (P1) through increased compliance (Wittkowski *et al.*, 2020), and by enabling healthcare consumers to have a more intuitive and informed understanding of the healthcare service (Hu *et al.*, 2019). Healthcare consumers who actively engage with this type of technology tend to reduce agency costs/risk and enhance efficiencies by making more informed decisions and participating actively, helping improve compliance (P1) (Calvillo *et al.*, 2015; Dadich and Doloswala, 2018). Ultimately, when managed appropriately, service robots can enhance dialogue and increase access to information, reducing information asymmetries and supplementing the existing healthcare professional/customer relationship, leading to enhanced well-being for all engaged actors (P3) (Čaić *et al.*, 2019).

Service robots have the potential to assist healthcare professionals and interact with healthcare consumers, providing customized healthcare, mitigating human error and delivering emotional-social and cognitive resources (P2) that can enhance well-being (P4) (Čaić *et al.*, 2019; Wirtz *et al.*, 2018). Service robots can provide meaningful human-technology experiences if they are perceived as "human-like" (Čaić *et al.*, 2019). However, service robots can also inhibit value co-creation and well-being outcomes (P4) depending on how much they are accepted and understood in terms of their emotional-social and cognitive complexity (Wirtz *et al.*, 2018).

Contributions and future research

WHO's (2018) vision of people-centered healthcare and consumers' need to be active agents has seen a demand for shared control in healthcare interactions (Lukersmith *et al.*, 2016). This, together with COVID-19 and the exponential growth of health technology (Sust *et al.*, 2020), has created different human-technology service realities. In this context, it is essential to understand how the well-being of engaged actors in the various human-technology realities is enhanced. The purpose of the paper was to identify the key mechanisms and influencing factors through which blended service realities affect engaged actors' well-being in a healthcare context. This has been achieved through the conceptualization of a blended human-technology service realities continuum and typology, and the development of a blended human-technology service realities conceptual framework and associated propositions. Essentially, we have identified the key mechanisms (shared control and emotional-social and cognitive complexity)

and influencing factors (agency, meaningful human-technology experiences and DART) that have impacts on well-being outcomes within blended human-technology service realities. Our framework provides a useful platform for future research.

Theoretical contributions

Healthcare services are experiencing unparalleled change and require frameworks that help understand blended human-technology service realities that now exist (Shore, 2020; Sust *et al.*, 2020). Our research and subsequent framework move service literature forward and make three specific key contributions.

First, we conceptualize a blended human-technology service realities continuum and typology that includes three human-technology realities – human-dominant, balanced and technology-dominant – drawn from synthesized literature, relevant for the contemporary healthcare environment that is endorsing and embracing health technology. Specifically, (1) we advance previous work by accounting for the role of technology in service interactions, our study extends Chen *et al.* (2020)'s work calling for understanding the dynamics of how well-being is co-created beyond collective actors' resource integration; (2) we expand on previous work in service research (Larivière *et al.*, 2017; Robinson *et al.*, 2020; van Doorn *et al.*, 2017) by bringing together disparate literatures on service realities; (3) more specifically, we build on Flavian *et al.*'s (2019) and Bower *et al.*'s (2017) reality-virtuality frameworks to incorporate other service realities and settings, clarify the terminology and present all categories in a single continuum. Along with the blended human-technology service realities concept, we develop a typology that provides details on each reality, including healthcare examples. Such conceptualization is not only useful for the healthcare context but could also be applied to other service contexts, for example, banking and retail.

Second, to realize people-centered healthcare, the asymmetry of medical knowledge between healthcare professionals and consumers and the consumer's responses to blended human-technology service realities must be considered by the healthcare professional throughout healthcare interactions (cf. Tsekleves and Cooper, 2017). We identify two key mechanisms that influence well-being outcomes in human-technology service realities: (1) shared control and (2) emotional-social and cognitive complexity. We propose that blended human-technology service realities (human-dominant, balanced and technology-dominant) elicit shared control and emotional-social and cognitive complexity (Wirtz *et al.*, 2018) of the healthcare service delivery which influences well-being outcomes for all actors. By doing so, we address the calls for understanding how healthcare consumers can be engaged to participate in healthcare services and how shared decision-making through resolving information asymmetry can be achieved (Danaher and Gallan, 2016) by introducing shared control as a key factor to achieving well-being for all actors in the interaction. Further, we extend work on technology in services that focuses primarily on technology-dominant realities, such as service robots and AI (Čaić *et al.*, 2019; Lariviére *et al.*, 2017; Wirtz *et al.*, 2018) by showing where these technologies sit in people-centered healthcare.

Third, we recognize three influencing factors, including agency, meaningful human-technology experiences and the use of DART, which impact the relationships between human-technology service realities, the two key mechanisms (i.e. shared control and emotional-social and cognitive complexity) and well-being outcomes. Specifically, we propose (1) how agency stimulates shared control with blended human-technology service realities, (2) how meaningful the human-technology experiences are perceived by either the healthcare professional or consumer (i.e. in terms of being purposeful, connected, coherent, resonant and significant) will influence the emotional-social and cognitive complexity and (3) the influence

of DART on the relationships between the two key mechanisms and well-being outcomes. In doing so, we extend value co-creation in healthcare literature (McColl-Kennedy *et al.*, 2012; Sweeney *et al.*, 2015) by identifying the key influencing factors of value co-creation and the well-being of engaged actors in blended human-technology service realities.

Managerial implications

Our framework is a useful platform in the healthcare context to better manage the impacts of blended human-technology service realities on certain customers and situations, and how healthcare services could be designed to address the impacts of shared control and emotional-social and cognitive complexity arising from the emergence of these service realities on well-being outcomes (cf. Ostrom *et al.*, 2015).

Human-dominant reality can be used when healthcare consumers want human interaction and the convenience of a virtual consultation (telehealth), or the situation warrants (e.g. pandemic, live rural, person with a disability) the use of a virtual consultation (Moss *et al.*, 2020). It can also be used when consumers are unable to self-manage or do not have the ability to engage, for example, mental health concerns, impaired cognitive function, chronic illness (Tobiasson *et al.*, 2015; Sweeney *et al.*, 2015) or experience digital user anxiety and/or low level of tech literacy and/or have little access to technology (Andersen *et al.*, 2019). Human-dominant reality is also appropriate when the circumstance or situation is sensitive and/or critical and requires high emotional-social delivery and interaction and/or is low in cognitive complexity, for example, online counseling or health consultation (Tibaldi *et al.*, 2011; Wirtz *et al.*, 2018). Importantly, this reality is best when information exchange, shared decision-making and communication of shared values are required, for example, initial consultations and follow-up consultations (Adams *et al.*, 2012; Coulter, 2012).

Balanced reality can be used when healthcare professionals need to monitor health conditions and facilitate efficient interventions and intervene (by health professionals), or increase compliance or metabolic monitoring that uses machine learning to determine the body's metabolic rate in real time (Chu *et al.*, 2018; Wittkowski *et al.*, 2020). This reality enables healthcare professionals to gain fast access and reliable information to/from healthcare consumers' data (Granja *et al.*, 2018). With the use of self-care Apps and watches, this reality requires the consumer to have the ability to self-create their healthcare (Zainuddin *et al.*, 2016).

A balanced reality can also be used when the circumstance or situation is both emotionally-socially and cognitively complex and/or when complex and high-risk health services require both technology support and human explanation (Hu *et al.*, 2019). This reality is also useful when there are multiple actors involved, helping to reduce miscommunication and improve interaction (Hu *et al.*, 2019).

Technology-dominant reality is particularly useful when healthcare professionals either need assistance or do not need to be involved with healthcare interactions, but meaningful human-technology experiences are still required in service deliveries. For example, service robots that can take care of both the functional and affective needs of consumers in aged care. Also, this reality is useful when healthcare consumers require remote monitoring, enabled by AI platforms where healthcare consumer data are triaged by an algorithm, where remote monitoring is supported by cloud computing and machine learning, and remote patient monitoring (Hu *et al.*, 2019).

Future research

The service sector has fundamentally changed due to COVID-19, with many organizations having to rethink service provision and service design, including finding new ways to engage vulnerable consumers (cf., Fletcher-Brown *et al.*, 2021). This new service marketplace requires

innovative research into the "new realities" of service ecosystems (Finsterwalder and Kuppelwieser, 2020; Karpen and Conduit, 2020), which we refer as blended human-technology service realities. Further research is required to understand the nuances and complexities of each reality within the framework for various service contexts. The proposed research agenda provides direction to advance a deeper understanding of the service realities in healthcare services and application to other service contexts. The research areas outlined in Table 3 pose potential research questions related to the human-technology service realities framework generally, and specifically for the three realities proposed – human-dominant, balanced and technology-dominant.

Areas of inquiry	Potential research questions/topics
Blended human-technology service realities (human-dominant, balanced, technology-dominant)	(1) Empirically examine the relationship between blended human-technology service realities and well-being outcomes using the proposed framework in healthcare and other service contexts (2) What conditions and environments within the entire healthcare ecosystem would each of the human-technology realities suit? (3) How can the blended human-technology service realities continuum and framework be adapted to other service contexts? (4) How do each of the blended human-technology service realities inhibit/enable value co-creation in other service contexts? (5) How do each of the blended human-technology service enhance/hinder the customer experience? (6) What specific role/s does technology play in each human-technology reality? (7) What is the future of these blended human-technology realities in a post-COVID-19 world? (8) How to engage vulnerable consumers in blended human-technology realities?
Mechanisms in human-technology service realities	(1) Empirically examine the effects of the identified mechanisms in healthcare and other service contexts a. How does shared control and emotional-social and cognitive complexity affect well-being outcomes within blended human-technology service reality? (2) What other mechanisms are important in the context of human-technology service realities to achieve well-being outcomes within blended human-technology service realities?
Influencing factors in human technology service realities	(1) Empirically examine the effects of the identified influencing factors in healthcare and other service contexts a. How do agency and meaningful human-technology experiences influence shared control and emotional-social and cognitive complexity respectively within blended human-technology service reality? b. How does DART influence well-being outcomes through shared control and emotional-social and cognitive complexity? (2) What other influencing factors enhance or prohibit value co-creation and well-being outcomes within blended human-technology service realities?

Table 3.
Research areas of inquiry related to the human-technology service realities framework

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