Consumer engagement with preventive health technologies: a double-edged sword for consumer wellbeing

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Abstract

Although preventive health technologies are commonly considered as enhancing consumer wellbeing, little is known about their unintended consequences. This paper explores the relationship between consumer engagement (CE) with preventive health technologies and wellbeing, to best understand when engagement is beneficial—versus detrimental—to consumer wellbeing. A thematic analysis of 30 in-depth interviews with users of such technologies reveal that (1) consumers engage with preventive health technologies based on a variety of health goals, (2) specific engagement trajectories result from those contrasting consumer health goals, and (3) the beneficial versus detrimental role of CE with preventive health technologies in consumer wellbeing is conditioned by the type of trajectories consumers engage in. This paper proposes a nuanced perspective by demonstrating that CE with preventive health technologies can be considered a double-edged sword for consumer wellbeing. While these technologies can support healthy routines, they can also lead to maladaptive behavior through over-engagement.

KEYWORDS

Wellbeing, consumer engagement, preventive health technologies, engagement trajectories, consumer health goals

1. INTRODUCTION

Wellbeing—consumers' subjective assessments of thoughts and emotions about their lives and activities (Ryan and Deci, 2001)—is considered as a number-one priority by more than half of consumers, and has gained even more interest following the COVID-19 crisis (McKinsey, 2024; Cruz-Cárdenas *et al.*, 2021). Because of the heightened importance of self-care (Wang *et al.*, 2023), consumers are increasingly looking for solutions that can address their wellbeing needs, as evidenced by the $480 billion sales of health-enhancing products and services in the United States in 2023 (McKinsey, 2024).

Preventive health technologies (PHTs)—defined as any technology, device or digital solution delivering services targeting the health-enhancing habits of consumers (Birkmeyer *et al.*, 2021) by collecting and processing personal health–related data (Canhoto and Arp, 2017)—have become popular tools in the wellbeing trend. For example, between 2014 and 2020, Fitbit users increased by roughly 350% (Statista, 2021), and approximately 71,000 new health and fitness apps were launched in 2020 alone (Leasure Opportunities, 2021). Consumers primarily adopt these technologies to enhance their physical wellbeing through aspects such as fitness, good sleep, and diet (Statista, 2023). Indeed, PHTs encourage consumers to invest personal resources to engage with the technology and perform preventive behaviors; thus, their transformative potential lies in their ability to actively promote a healthy lifestyle (Sweeney *et al.*, 2015) and to be a key partner in consumers' quest for wellbeing.

Although PHTs are commonly considered as a solution to enhance consumer wellbeing, little is known about how maladaptive behavior can occur following interaction with PHTs (Boland *et al.*, 2020), and thus about their detrimental effect on wellbeing (Batat and Hammedi, 2023). A small but growing number of recent studies point to the potential harm that new technologies such as social media (e.g., Chan *et al.*, 2022; Chatzopoulou *et al.*, 2020; Zahrai *et al.*, 2022) and mobile apps (e.g., Capito and Pergelova, 2022) can cause to consumers. Indeed, engaging

with new technologies can induce negative experiences and stress (Kumar *et al.*, 2022), reduced self-love and acceptance (Javornik *et al.*, 2022), poor mental health (Rosenbaum *et al.*, 2022) and loss of wellbeing (O'Brien *et al.*, 2022), for instance. More specific to the context of PHTs, recent studies have urged researchers to "assess platform-facilitated consumer engagement (CE) and its long-term effects on wellbeing" and, particularly, to discover "to what extent might new technologies, such as self-tracking devices, actually contribute to (vs. jeopardize) wellbeing" (Hollebeek *et al.*, 2022, p. 301). Furthermore, researchers are encouraged to investigate evolving consumers' motivations and experience while interacting with such technologies (Peterson *et al.*, 2021). As further highlighted by recent literature reviews (e.g., Mwangi *et al.*, 2024), understanding when and why health-enhancing technologies like PHTs backfire is thus fundamental given their adoption rate and the potential threat they could pose to consumers.

One potential factor relevant to addressing the relationship between CE with PHTs and wellbeing lies in consumers' motivation for engaging with a PHT, referred to as consumer health goals. Indeed, CE is inherently driven by consumer involvement (Do *et al.*, 2020), as a goal pushes consumers to direct attention, effort, and action (i.e., invest resources) toward the desirable state (Locke and Latham, 2006). Accordingly, and because engagement highly depends on the motivational state of the consumer (Hollebeek *et al.*, 2019), exploring the roles of goals seems to represent a promising and understudied avenue to understanding the dynamic evolution of CE with PHTs (i.e., the trajectory of engagement) and its relationship to wellbeing.

Accordingly, this paper aims to explore the relationship between CE with PHTs and wellbeing, to best understand when engagement is beneficial—versus detrimental—to consumer wellbeing. We do so by focusing on consumer health goals and CE trajectories. Given the research gaps discussed above, we examine the following research questions: (1) How does CE

with PHTs affect wellbeing? and (2) What is the role of consumer health goals and engagement trajectories in consumer wellbeing?

We adopt an exploratory research approach, using in-depth interviews with 30 PHT users and abductive thematic analysis to fuel our understanding of the relationship between CE with PHTs and wellbeing. We show how consumer health goals and engagement trajectories influence how CE with PHTs unfolds. Our data further show that these engagement trajectories are crucial in explaining the conditions under which CE with PHTs is beneficial or detrimental to consumer wellbeing.

This investigation responds to several calls for research on the relationship between CE with technology and wellbeing (e.g., Hollebeek and Belk, 2021), thus offering important insights currently overlooked in the literature (Lim *et al.*, 2022). Considering that new technologies are one of the most dramatic forces in the current marketing environment, investigating not only positive outcomes related to CE with technology (currently the predominant approach in the literature; Bowden *et al.*, 2015) but also potential pitfalls for consumers is critical *(*Donthu *et al.*, 2021; O'Brien *et al.*, 2022). By shedding light on the conditions under which CE with PHTs can be beneficial versus detrimental to consumer wellbeing, we provide a nuanced approach by uncovering paradoxical outcomes for consumer wellbeing following engagement with PHTs. This approach enriches current scholarship addressing the benefits or harm of PHTs largely separately, with a predominance of positive perspectives (Chen *et al*., 2024; Mwangi *et al.*, 2024). In addition, to fully apprehend the role of CE with PHTs in consumer wellbeing, we move from dominant conceptualizations of CE (i.e., a static and stable process) to a broader perspective by considering it an evolving and dynamic phenomenon (Alkire *et al.*, 2022; Flaherty *et al.*, 2021). In particular, we focus on an emerging stream of CE literature by exploring how its dimensions vary in level and valence (Naumann *et al.*, 2020). This contribution is also made possible thanks to the exploration of interrelated and dynamic

consumer goals, which shape consumers' experience with PHTs (Flaherty *et al.*, 2021). Finally, this study expands the literature on PHTs by going beyond positivist investigations on technology adoption and usage (e.g., Huang and Ren, 2020; Yousaf *et al.*, 2021) and considering how CE with PHTs unfolds and is experienced in actual practice.

2. THEORETICAL FRAMEWORK

2.1. Wellbeing in the age of new technologies

The academic literature often links wellbeing to the quality of psychological experiences (Ryan and Deci, 2001); thus, the term generally denotes consumers' subjective evaluations of their cognitive judgements and affective states (Diener and Emmons, 1984). Accordingly, hedonic wellbeing relates to how people subjectively evaluate their lives (Kahneman *et al.*, 1999), based on emotional reactions, moods and the judgements they form about specific events (Ryan and Deci, 2001). Other conceptualizations focus on the eudaimonic aspect of wellbeing—that is, consumers' self-realization and creation of meaning when they behave in accordance with deeply held values (Waterman, 1993). Eudaimonic wellbeing positively influences consumers' affect, which in turn influences their experience of subjective wellbeing. Accordingly, wellbeing is conceptualized in this study as a multidimensional phenomenon that includes aspects of both conceptions: hedonic and eudaimonic wellbeing (Ryan and Deci, 2001).

Given the prevalence of new technologies in consumers' daily lives (Donthu *et al.*, 2021), an increasing number of studies have investigated the relationship between technology and consumer wellbeing (e.g., Kumar *et al.*, 2022; Rosenbaum *et al.*, 2022). In particular, recent research has examined the relationship between CE and wellbeing in the contexts of smart services (e.g., Henkens *et al.*, 2021), gamification (e.g., Hammedi *et al.*, 2021) and augmented reality (e.g., Javornik *et al.*, 2022), among others. Despite this nascent interest, however, wellbeing remains understudied in the CE literature, and scholars have actively called for future

research that investigates CE's relevance in fostering consumer wellbeing (e.g., Hollebeek and Belk, 2021), especially studies that consider not only the positive outcomes of CE but also potential pitfalls for consumer wellbeing (Donthu *et al.*, 2021; O'Brien *et al.*, 2022). Therefore, this study explores the role of CE with PHTs in enhancing (vs. decreasing) consumer wellbeing, through the lens of the theory of conservation of resources (COR). The core tenet of COR stands that "people strive to retain, protect, and build resources and that what is threatening to them is the potential or actual loss of these valued resources" (Hobfoll, 1989, p. 516). Accordingly, interactions with new technologies may positively and negatively impact consumer wellbeing, contingent upon individual resources and the net benefits derived from these interactions. Furthermore, CE serves as a pivotal mechanism within the COR theory, capable of depleting and enhancing consumer resources. Indeed, consumers interact with technologies to bolster existing resources or mitigate potential losses (Hollebeek *et al.*, 2023). The following section delves deeper into the concept of CE and its relationship with PHTs.

2.2. Consumer engagement with preventive health technologies

Consumer engagement[1] has gained momentum in the past 15 years and emerged as an important marketing metric (Hollebeek *et al.*, 2022), partly due to its promise for developing, maintaining and growing consumer satisfaction as well as business profitability (Lim *et al.*, 2022). Researchers define CE as consumers' motivationally driven resource investment in their interactions with brands in service systems (Hollebeek *et al.*, 2019; Kumar *et al.*, 2019). In addition, studies have conceptualized CE as multidimensional, organizing it by (1) cognition and thought, (2) affect and feelings and (3) behavioral actions (Hollebeek *et al.*, 2019). The behavioral dimensions of CE can initially be fostered by thoughts and affect, which in turn

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[1] Although the terms "customer engagement" and "consumer engagement" are different semantically, the literature emphasises a high degree of similarity in their conceptual core, which leads us to view them as highly related concepts (Hollebeek *et al.*, 2019, 2022).

strengthen potential cognitive and affective dimensions, which then influence behavioral CE. This continuing cycle demonstrates the interrelatedness of these dimensions (Lim *et al.*, 2022).

Recent reviews of the CE literature (e.g., Hollebeek *et al.*, 2022; Lim *et al.*, 2022) highlight that most studies currently take the brand as their focal engagement object; thus, further research is necessary to better understand how CE with other objects might differ. This research specifically treats PHTs as the engagement object. Notable examples of PHTs include health and fitness apps, such as Strava (running and cycling) and HeadSpace (meditation and stress management), and wearables, such as the FitBit smartwatches (physical activity and sleep), as well as smart objects, such as Garmin scales (weight and body composition monitoring). PHTs as engagement objects are particularly distinctive in the diverse types of data they capture and the degree to which they are unobtrusively integrated into consumers' daily lives (Akdevelioglu *et al.*, 2022). This easy access to physiological and behavioral information increasingly allows consumers to self-manage their wellbeing. Consequently, PHTs are frequently designed and marketed to enhance wellbeing (Mwangi *et al.*, 2024; Sweeney *et al.*, 2015). However, the extent to which these technologies effectively achieve this goal remains largely unknown (Chen *et al.*, 2024). Therefore, investigating the relationship between CE with PHTs and wellbeing is warranted.

Furthermore, Brodie *et al.* (2011) explain that CE is context dependent and occurs in an ecosystem (here, the preventive behavior ecosystem) that consists of technology and non-technology actors which interactively facilitate and stimulate individuals in their actions. In other words, consumers interact with various objects at a time, and both the action and the technology are co-constitutive of engagement (Morgan-Thomas *et al.*, 2020). Within the scope of PHTs, the ecosystem both includes the technology and the preventive health behaviors targeted. Those engagement objects are inseparable and concurrent within the preventive behavior ecosystem. Indeed, in service systems, multiple, interdependent engagement foci exist

(Sim *et al.*, 2018). Accordingly, CE with different foci can occur concurrently and affect one another (Brodie *et al.*, 2011).

Given the nature of the PHT and the activity it fosters, CE with the PHT and with the preventive health behavior is inextricably linked. On this basis, this study adapts Hollebeek *et al.* (2019, p. 166) definition of CE and conceptualizes CE with PHTs as consumers' motivationally driven investment of cognitive, emotional, and behavioral resources in interactions with PHTs and, more globally, with their own health and wellbeing.

Researchers have recently taken an interest in consumer behavior towards PHTs (see Table 1 for an overview of key empirical articles published in consumer research, marketing, information technology, and other relevant disciplines). The technologies evaluated are usually specific kinds of PHTs, such as apps (e.g., Santos-Vijande *et al.*, 2022) and trackers (e.g., Zhou *et al.*, 2022). Furthermore, the main focus is fitness (e.g., Yousaf *et al.*, 2021); however, PHTs can address many other preventive behaviors. In addition, the current body of literature predominantly takes a positivistic approach and concentrates on testing specific drivers of adoption, such as demographics (e.g., Bol *et al.*, 2018), individual factors including health consciousness and literacy (e.g., Lee and Lee, 2018) and technological affordances such as information quality (e.g., Cheung *et al.*, 2019). Drivers of PHT usage have also received considerable attention, such as individual (e.g., self-efficacy; Huang and Ren, 2020), social (e.g., belonging and norms; Chen *et al.*, 2020) and technological (e.g., perceived usefulness; Canhoto and Arp, 2017) antecedent variables. Recent literature reviews on PHTs have reached similar conclusions, highlighting a predominance of quantitative studies concerning adoption and usage (Chen *et al.*, 2024; Mwangi *et al.*, 2024).

Authors	Methodology used	Technology	Consumer behavior	Key antecedents	Consumer wellbeing outcomes (+): positive/ (-): negative
Canhoto and Arp (2017)	5 focus groups (N=20)	Health and fitness wearables and apps	Adoption, Usage	Device factors (e.g., individual goals, usefulness, accuracy), context factors (e.g., community), user-related factors (e.g., technology affinity)	None
Beldad and Hegner (2018)	Online survey (N=476)	Fitness apps	Usage	Perceived ease of use, perceived usefulness, social norm	None
Bol et al. (2018)	Online survey (N=1079)	Health apps	Adoption	E-health literacy, age, education	None
Lee and Lee (2018)	Online survey (N=616)	Fitness trackers	Adoption	Consumers attitudes, personal innovativeness, health interests	None
Cheung et al. (2019)	Online survey (N=171)	Health wearables	Adoption	Health belief, quality of information, reference group influence, perceived usefulness, consumer innovativeness	None
Flaherty et al. (2019)	In-depth interviews (N=12)	Health apps	Engagement	Motivation to change the behavior, anticipated effort	None
Lin and Windasari (2019)	Longitudinal cultural probe technique (N=21)	Fitness trackers	Usage	Technology efficacy, health efficacy	Quality of life improvements (+) (-)
Chen et al. (2020)	Online survey (N=356)	Fitness apps	Usage	Perceived usefulness, perceived enjoyment, sense of belonging, habit formation, satisfaction	None
Huang and Ren (2020)	Online survey (N=449)	Fitness apps	Usage	Perceived usefulness, perceived ease of use, perceived enjoyment, exercise self-efficacy	None
Birkmeyer et al. (2021)	Content analysis of top apps (N=10); in-depth interviews with users (N=11), expert academics (N=9), and practitioners (N=7); online survey (N=249)	mHealth apps	Usage	User satisfaction with mHealth app (e.g., personalization), attitude towards mHealth (e.g., health consciousness), word-of-mouth	None
Chiu et al. (2021)	Online survey (N=342)	Health and fitness apps	Usage	Perceived usefulness, satisfaction, commitment	None
Flaherty et al. (2021)	Phenomenological and experience-centered perspective (N=10): in-depth interviews, reflexive accounts, observations	Health apps	Engagement	Involvement, congruency with personal goals, perceived value	None
Kim (2021)	Three independent waves of online surveys (N=343)	Fitness apps and wearable devices	Usage	E-servicescape dimensions	None
Yousaf et al. (2021)	Longitudinal online surveys (N=526)	Fitness apps	Usage	Technology self-efficacy, user-interface quality, perceived privacy	Health satisfaction (+)
Zhou et al. (2022)	Online survey (N=970)	Fitness trackers	Engagement	Interactivity, navigability, customization	Preventive health behaviors (+)
Santos-Vijande et al. (2022)	Online survey (N=400)	mHealth apps	Engagement	Functional value, hedonic value, social value	None

TABLE 1 Key empirical papers investigating consumer behavior towards PHTs

Table 1 shows that the current literature is limited in understanding the relationship between CE with PHTs and consumer wellbeing. For example, few studies (with the exception of Lin and Windasari, 2019; Yousaf *et al.*, 2021; Zhou *et al.*, 2022) investigate the outcomes of CE with PHTs on consumer wellbeing, and those that do focus mainly on the sustained adoption of healthy routines. In other words, these studies provide no certainty that performing the preventive health behavior will sustainably foster positive experiences and meaning for consumers (Ryan and Deci, 2001), without any detrimental consequences on their wellbeing. This echoes literature reviews on analogous technologies, which observe general tendencies toward a positive perspective (Chen *et al.*, 2024), often overlooking actual measures of wellbeing (Mwangi *et al.*, 2024).

In addition, Table 1 shows that basic forms of PHT-related behaviors, such as adoption or usage, are currently predominant in the PHT literature; however, CE constitutes a more relevant objective to attain, considering its long-term and multidimensional perspective (Hollebeek *et al.*, 2019), as well as its key role in behavior change (Schoeppe *et al.*, 2016).

Furthermore, studies on CE with PHTs tend to treat CE as a static and stable process, but recent research has emphasized the dynamic and changing nature of CE based on consumer adaptation (Alkire *et al.*, 2022; Flaherty *et al.*, 2021; Jaakkola and Alexander, 2024). Studies show that CE can have various valences and varying levels, or intensities (Bowden *et al.*, 2015; Do *et al.*, 2020), and can vary for different consumers within the same group (Dessart *et al.*, 2019) or for an individual consumer through time (Bowden *et al.*, 2015). CE can evolve or range from high to low and from positive to negative, or even exist in passive form, conceptualized as disengagement (Do *et al.*, 2020; Naumann *et al.*, 2020; O'Brien *et al.*, 2022). Accordingly, we take a dynamic approach in contextualizing CE with PHTs, as we aim to explore the role engagement trajectories can play regarding wellbeing. We conceptualize engagement trajectories as the longitudinal patterns or paths observed in consumers' levels of engagement

over time with a particular object (in this case, PHTs). In other words, it denotes the different levels and valences of engagement experienced by consumers, starting from the initiation of their relationship with the PHT.

The literature on the dynamic nature of engagement is still nascent, and little is known about which factors may sustain different engagement levels and valences (Naumann *et al.*, 2020). While existing research on CE highlights many antecedents (e.g., satisfaction, participation, trust), these studies mainly adopt a cross-sectional approach (Do *et al.*, 2020). Consequently, the specific variables fostering a dynamic evolution of CE (i.e., CE trajectories) still need to be explored.

Involvement has received particular attention within CE's known antecedents (Do *et al.*, 2020). Consumer involvement has been conceptualized as an "individual's level of interest and personal relevance in relation to a focal object in terms of their basic values, goals, and self-concept" (Brodie *et al.*, 2011, p. 261). Goals push consumers to direct attention, effort, and action (i.e., invest resources) toward relevant actions to reach a desirable state (Locke and Latham, 2006). Consumer goals are thus particularly relevant given the motivational nature of CE, according to which their goal-oriented nature drives consumers' interaction with an engagement object (Hollebeek *et al.*, 2019). The uses-and-gratifications theory further stipulates that individuals seek media and experiences to fulfil their needs and goals (Blumler and Katz, 1974). Furthermore, in the eudaimonic view of wellbeing, goals also substantially affect one's mindset and mental health (Ryan and Deci, 2001). While consumer goals seem to represent a promising key to understanding the dynamic evolution of CE with PHTs (Flaherty *et al.*, 2021), no clear view has emerged on the specific impact of goals that may link CE with PHTs to consumer wellbeing.

Accordingly, this study aims to fill these research gaps by shedding light on how CE with PHTs affects wellbeing. More specifically, we explore the conditions under which CE with PHTs is beneficial or detrimental to consumer wellbeing by focusing on consumers' health goals and engagement trajectories. In particular, because CE can take diverging intensities and valences (Bowden *et al.*, 2015), some forms of CE might enhance and other undermine wellbeing.

3. METHODOLOGY

Considering the study's exploratory nature, 30 in-depth interviews with users of PHTs were conducted. Indeed, a qualitative approach is highly suited when seeking to understand how things occur from the informant's perspective (Holmlund *et al.*, 2020). Using convenience and snowball sampling, we targeted individuals who were users of mobile apps, smartphones, smart wearables, or smart objects targeting preventive health behaviors (i.e., PHT). Data were collected until saturation was reached, and no further information was retrieved regarding the emerging findings (Guest *et al.*, 2006; Mason, 2017).

The final sample comprises 30 PHT users, aged 16 to 78 years (mean: 30), with a gender distribution of 50% of female (see Table 2 for respondents' characteristics). We ensured diversity within the pool of participants across several dimensions. First, we included respondents from different age groups, reflecting the prevalence of PHT usage among Generation Z and Y (McKinsey, 2024). Second, respondents exhibited diverse health profiles, reflecting varying degrees of prioritization of wellness in their daily decisions. This assessment was conducted by gauging the importance of healthy activities and monitoring in their lives. It was categorized into low, moderate, and high levels based on the extent of involvement and dimensions considered. Thirdly, respondents varied in their technology integration tendencies and its significance in their daily lives. For instance, some solely used basic PHTs (e.g., step trackers; low technology integration), while others engaged with multiple PHT devices and apps across a span of preventive health behaviors (high technology integration). Finally,

respondents tracked various preventive health behaviors, including physical activity, nutrition, weight, sleep, mindfulness, shopping habits, and reproductive health. In line with past research exploring consumer responses to innovative services and technologies (e.g., Hazée *et al.*, 2017; Pitardi and Marriott, 2021), we opted for a broad range of preventive health behaviors and related technologies to understand the phenomenon in general. Indeed, most research on PHTs in business literature has to date focused on fitness apps (e.g., Beldad and Hegner, 2018; Huang and Ren, 2020; Zhou *et al.*, 2022) and this focus could not offer a suitable insight on the research questions at hand. Table 2 further highlights the heterogeneity within the sample along the dimensions cited above.

	Gender	Age (years)	Interview length (min)	Occupation	Technology integration	Health profile	Preventive behavior targeted						
							PA	NU	WE	SL	MD	SH	RH
1	Male	29	83	Consultant	Moderate	High	●			●	●		
2	Female	25	56	Consultant	Moderate	Basic	●		●				
3	Female	53	45	Teacher	Basic	Moderate						●	
4	Male	31	63	Security guard	Moderate	Moderate	●	●	●				
5	Male	78	45	Retired	Basic	Basic	●						
6	Female	24	56	University student	Moderate	Moderate	●	●	●				●
7	Male	19	48	University student	Moderate	Basic	●						
8	Male	53	49	Accountant	Basic	Basic	●						
9	Female	27	44	Consultant	Moderate	Basic	●	●	●				
10	Female	31	46	Teacher	Moderate	Basic	●			●			
11	Male	26	63	Consultant	High	Moderate	●			●			
12	Female	40	33	Teacher	Basic	Basic	●					●	
13	Female	41	36	Florist	Basic	Moderate	●						
14	Male	39	27	Financial manager	Basic	Basic	●						
15	Female	41	54	Professor	Basic	Moderate	●				●		
16	Female	33	64	Professor	Moderate	Moderate	●	●				●	
17	Female	22	52	University student	High	High	●			●			●
18	Female	25	51	Researcher	Basic	Moderate	●				●		
19	Female	24	31	Consultant	Basic	Moderate	●						
20	Female	37	51	Marketing manager	High	High	●		●	●	●	●	●
21	Male	32	64	Consultant	High	High	●	●	●	●			
22	Male	37	56	Entrepreneur	Basic	Basic						●	
23	Female	16	28	High school student	Basic	Basic	●			●			

24	Male	17	20	High school student	Basic	Moderate	•						
25	Male	17	29	High school student	Moderate	High	•	•	•	•			
26	Female	17	41	High school student	Moderate	Moderate	•		•	•	•		
27	Male	18	23	High school student	Basic	Basic	•						
28	Male	16	30	High school student	Basic	Basic	•						
29	Male	17	28	High school student	Basic	Moderate	•		•				
30	Male	16	31	High school student	Basic	Moderate	•		•				
Frequency Average	*15F, 15M*	**30**	**45**				*28*	*6*	*10*	*9*	*6*	*4*	*3*

TABLE 2 Profile of respondents

0 Notes: MA = mobile apps, WE = wearables, SS = smart scale, PA = physical activity, NU = nutrition, WE = weight, SL = sleep, MD = mindfulness, SH = shopping habits, RH = reproductive
1 health.

Interviews were flexible and, to address our research questions, concentrated on the interviewees' relationship with their PHTs, with a particular focus on describing the initiation and evolution of this relationship. We used specific and recurring prompts to bring to light the emotions and thoughts the technology fostered as well as their impact on the respondents' emotional states and behaviors, which gave us insight into how their wellbeing related to their engagement with the PHT.

Data analysis commenced concurrently with data collection, aiming to ensure rigor throughout the research process (Wittel *et al.*, 2020). We transcribed each interview, resulting in 212 single-spaced pages of text, which were then imported into NVivo 12 software for analysis. Following recommendations for qualitative research excellence (Wittel *et al.*, 2020), we adopted an abductive reasoning approach, synthesizing empirical observations with existing literature (Dubois and Gadde, 2002; Holmlund *et al.*, 2020). The analysis proceeded in two stages: Stage 1 involved building a solid theoretical foundation of the antecedents, dimensions, and consequences of CE with technology, guided by the marketing, business, and IT literature. Once these were identified and categorized into pre-established codes, Stage 2 involved a thematic analytic approach, identifying emerging themes and categories through open coding (Braun and Clarke, 2006; Corbin and Strauss, 2015). We iteratively refined and categorized the data, drawing on relevant literature to inform our analysis (Fischer and Guzel, 2023; Grodal *et al.*, 2021). Finally, we juxtaposed categories to uncover potential patterns within the data (Locke *et al.*, 2022), which brought to light the various trajectories by which CE with PHTs can unfold and their effects on wellbeing. Specifically, we categorized 26 first-level codes into eight second-order themes that underpin the insights developed in the results section (see Web Appendix 1 for further details). To ensure the consistency of this process, specific examples were shared among the research group, and descriptions of each were proposed and discussed extensively through multiple iterations.

4. RESULTS

Insights from in-depth interviews revealed that (1) consumers engage with PHTs based on a variety of health goals, (2) specific engagement trajectories result from those contrasting consumer health goals, and (3) the beneficial versus detrimental role of CE with PHTs in consumer wellbeing is conditioned by the type of trajectories consumers engage in. These key results are summarized in Table 3 and are presented in detail in the next subsections.

Trajectory	Goal orientation	Consumer profiles	Propositions
Type 1: Settling engagement	Both functional and hedonic orientation **Low need for data**	Curious learner Pleasure seeker	**P1**: Consumers with a low need for data are inclined to engage with the PHT in a way that promotes long-term wellbeing.
Type 2: Engagement curve	Both functional and hedonic orientation **Low need for data**	Curious learner Pleasure seeker	
Type 3: Detrimental over-engagement	Both functional and hedonic orientation **High need for data**	Problem-solver Performance optimizer	**P2**: Consumers with a high need for data are inclined to engage with the PHT in a way that harms long-term wellbeing. **P3**: Detrimental over-engagement can occur toward the preventive health behavior and/or toward compulsive technology usage.
Type 4: Bumpy engagement	Combination / **dynamic** approach to goals	All profiles	**P4**: Evolving consumer goals manifest in fluctuating engagement patterns with PHTs, influencing both long-term wellbeing and illbeing.

TABLE 3 Summary of key insights

4.1. Consumer health goals

Our in-depth interviews highlighted the key role of consumer health goals in the development of their engagement with the PHT. More specifically, the data suggest a matrix of consumer health goals, classified according to (1) the hedonic versus functional orientation of the preventive health goal and (2) the high versus low need for data to fulfil the goal. Accordingly, four key segments emerged, which we illustrate in Figure 1: "the problem-solver" (high need for data to fulfil a functional goal; e.g., tracking data to lose weight), "the performance optimizer" (high need for data to fulfil a hedonic goal; e.g., analyzing data to improve

performance), "the pleasure seeker" (low need for data to fulfil a hedonic goal; e.g., monitoring data of an enjoyable activity) and "the curious learner" (low need for data to fulfil a functional goal; capitalizing on data to acquire a healthy routine).
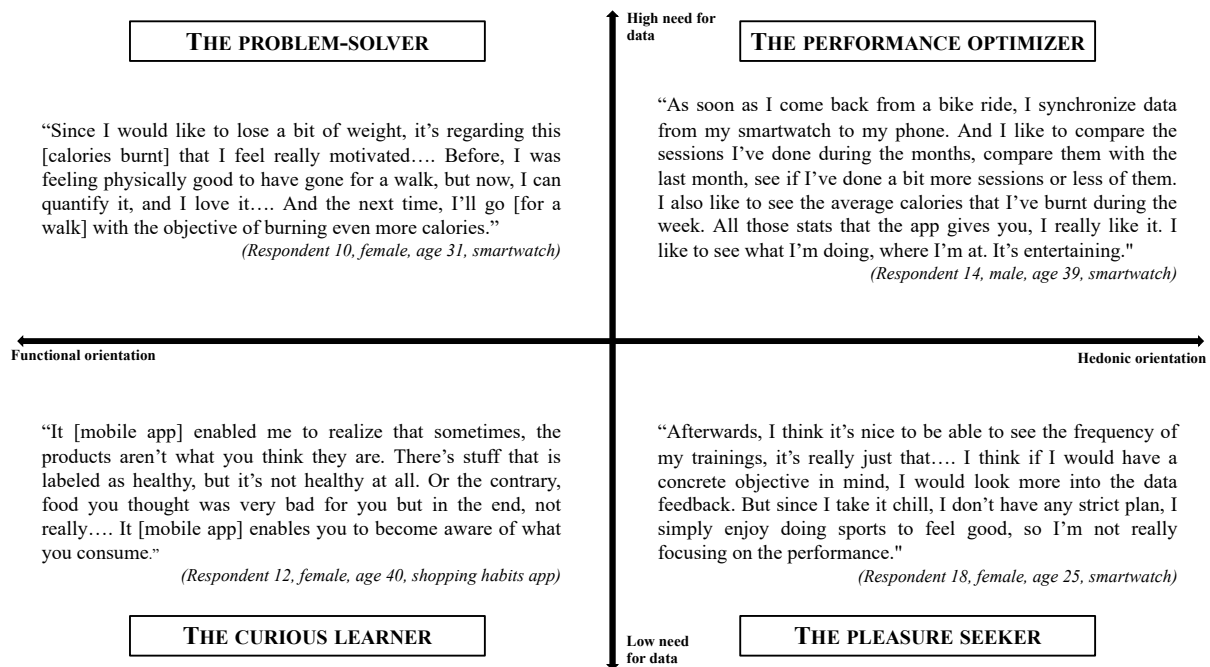

THE PROBLEM-SOLVER

"Since I would like to lose a bit of weight, it's regarding this [calories burnt] that I feel really motivated…. Before, I was feeling physically good to have gone for a walk, but now, I can quantify it, and I love it…. And the next time, I'll go [for a walk] with the objective of burning even more calories."
(Respondent 10, female, age 31, smartwatch)

High need for data

THE PERFORMANCE OPTIMIZER

"As soon as I come back from a bike ride, I synchronize data from my smartwatch to my phone. And I like to compare the sessions I've done during the months, compare them with the last month, see if I've done a bit more sessions or less of them. I also like to see the average calories that I've burnt during the week. All those stats that the app gives you, I really like it. I like to see what I'm doing, where I'm at. It's entertaining."
(Respondent 14, male, age 39, smartwatch)

Functional orientation

Hedonic orientation

"It [mobile app] enabled me to realize that sometimes, the products aren't what you think they are. There's stuff that is labeled as healthy, but it's not healthy at all. Or the contrary, food you thought was very bad for you but in the end, not really…. It [mobile app] enables you to become aware of what you consume."
(Respondent 12, female, age 40, shopping habits app)

"Afterwards, I think it's nice to be able to see the frequency of my trainings, it's really just that…. I think if I would have a concrete objective in mind, I would look more into the data feedback. But since I take it chill, I don't have any strict plan, I simply enjoy doing sports to feel good, so I'm not really focusing on the performance."
(Respondent 18, female, age 25, smartwatch)

THE CURIOUS LEARNER

Low need for data

THE PLEASURE SEEKER

FIGURE 1 Matrix of consumer health goals

The circular arrow in Figure 1 highlights that consumers can travel from one goal category to another depending on their context. For instance, a consumer may start using a fitness band out of curiosity to get more information on their current cycling hobby ("pleasure seeker") and later capitalize on the data collected to gradually improve their performance ("performance optimizer"). Another example is emphasized by Respondent 25, who discusses his relationship with a calorie counter app, which first started with a functional weight loss goal with a high need for data:

When I was 15, I really started using it for diet reasons, and intensive physical activity. And so, for 4 months, I really used it [calorie counter app] thoroughly, so that I would lose 20 kilos. […] During these 4 months, my [weight loss] objective was more important than anything else. I would follow the instructions to the letter. *(Respondent 25, male, age 17, calorie counter app)*

As time passed and the relationship with the PHT and preventive health behavior evolved, the respondent discusses a shift in his goal orientation toward the same app, which is now rather seen as a tool to support himself through lower needs of data:

> And then, I would use it again, but more in an informational way, sometimes just out of curiosity to see what I was eating, to make sure that I would still be careful, but with some slack. […] I'm using the app, the app is not using me, you know. It's like using a Word document or an Excel sheet. I'm deciding. *(Respondent 25, male, age 17, calorie counter app)*

Moreover, consumers can use one PHT to fulfil different goals and needs, though they usually focus on a major goal towards which they direct their thoughts and efforts while engaging with the PHT. Accordingly, different consumer health goals can result in the manifestation of contrasting CE levels and valences. For example, consumers trying to reach a hedonic goal through a low need for data will tend to moderately engage with the PHT, focusing on positively valenced dimensions of CE, such as feelings of joy and entertainment. Conversely, consumers with a high need for data tend to put significant importance on the technology feedback, which can sometimes lead to intense levels of CE with the PHT as well as negative thoughts and emotions, as the following quote emphasizes:

> I personally feel that when you're using those kinds of apps [calorie counter apps], your mental health will always be at stake. Because you're not doing it innocently, in the sense that there's always some kind of objective behind, like a weight loss. So, there's already an uneasiness regarding yourself. And the app will reflect it: did you manage to reach your objective or not, are you still a piece of sh*t or not. *(Respondent 6, female, age 24, calorie counter app)*

These differences in CE levels and valences are reflected in how CE with PHTs develops and changes over time, leading consumers to follow different trajectories while engaging with their PHT, which sheds light on the beneficial (vs. detrimental) role of CE on consumer wellbeing.

4.2. Trajectories of CE with PHTs and wellbeing

Our data reveal the existence of different dynamics of CE with PHTs, fostered by differences in CE levels and valences resulting from contrasting consumer health goals. In particular, respondents followed four trajectories of CE with PHTs: settling engagement, engagement curve, detrimental over-engagement and bumpy engagement (see Figures 2–5).

4.2.1. Trajectory type 1: Settling engagement

Respondents often begin engaging incrementally with the PHT, building on curiosity and sustained interest (i.e., the curious learner):

> My usage intensity, it grew progressively. At first, I would only use the [scanning] app
> for certain types of products. But then, I started to notice that I could use it on more
> products and so, I widened my searches and now, I'm trying with literally everything.
> *(Respondent 3, female, age 53, shopping habits apps)*

This incremental engagement stabilizes over time around a baseline level, often concurrently with the preventive health behavior involved. For this stabilization to occur, consumers' interactions with the PHT need to be satisfactory and foster positive emotions and thoughts, as well as be helpful in their daily lives. In other words, consumers must exhibit rather positively valenced engagement with the PHT, such as emotions of pride and entertainment, thoughts of self-achievement and learning, and a consistent practice of the preventive behavior. For example:

> I usually track when my period starts and when it ends. I open the app various times a
> month, because I check when my period is about to come, see if I'm late or not. I'll check
> on the first day of my period, telling the app it [period] has started. I'll also notify the app
> when it ends. And during the month, I'll monitor sometimes if I had sexual intercourse, if
> I feel particular symptoms, like ovulation or some pain…. This is something that helps me
> be more efficient in my life, more productive, save time and energy. *(Respondent 20,
> female, age 37, reproductive health app)*

Around this baseline level, consumers tend to engage with the technology at around the same pace as with the preventive health behavior targeted. In other words, the PHT might have fostered their awareness and knowledge of the preventive health behavior, and through increased engagement, became a true partner to an enjoyable behavior, leading them to switch to a hedonic perspective (i.e., the pleasure seeker). Given that this engagement trajectory manifests largely through positive thoughts and affect, fostered by both the PHT and the regular practice of the preventive behavior, it tends to be beneficial to consumer wellbeing (see Figure 2).
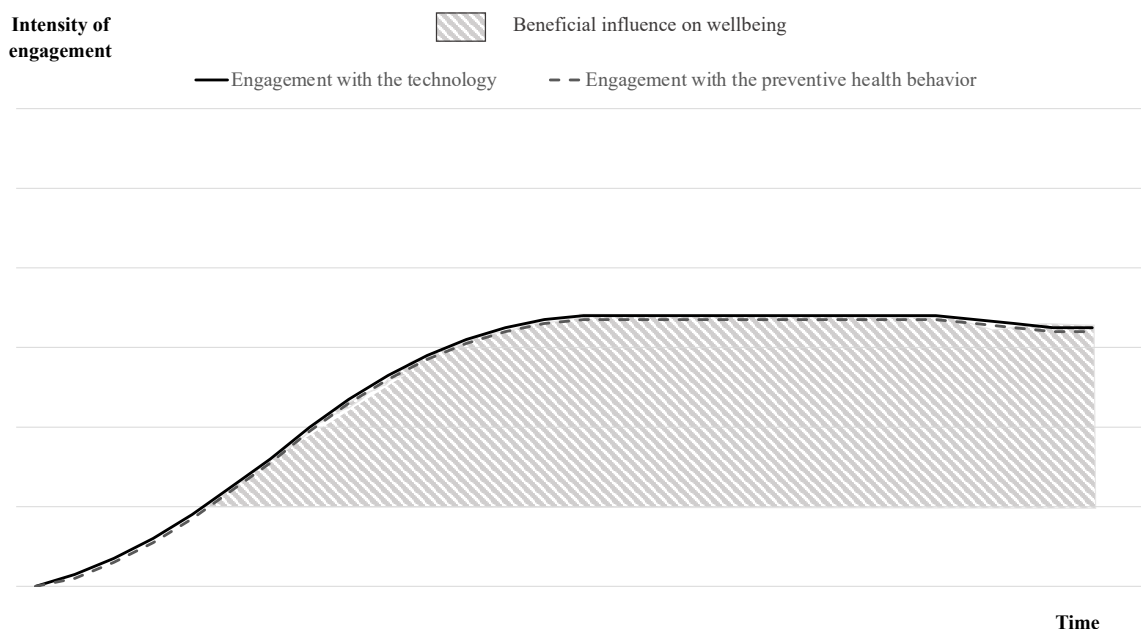
FIGURE 2 Settling engagement trajectory

4.2.2. Trajectory type 2: Engagement curve

Respondents beginning their relationship with the PHT through a low need for data might follow a second trajectory while engaging with the PHT, in which their incremental engagement fades over time. Their behavioral engagement is focused on using the PHT to learn, which often leads them to experience positive affect and thoughts such as curiosity, inspiration and achievement. When they feel they have mastered the behavior, they might end up disengaging

completely from the PHT, while still engaging with the preventive health behavior targeted, as the following quote suggests:

> I was using this app especially in the past, to know the quantity of calories I was eating, the ratio of proteins, carbohydrates, lipids.… All of this, I was monitoring it a lot at the beginning, when I was really tracking everything. It helped me to learn and know it all in detail. But now, any food, I know what it provides, because I've used the app for a long time.… Now, it's all in my head, I don't need the app anymore, I can monitor without it. *(Respondent 4, male, age 31, calorie counter app)*

Within this context, disengagement might not be considered a failure, as it is the reflection of consumers acquiring sufficient resources to practice the preventive health behavior on their own. Consequently, this trajectory of CE can also play a beneficial role in the wellbeing of consumers, especially as it fosters the acquisition and mastering of healthy routines as well as positively valenced manifestations of engagement (see Figure 3).
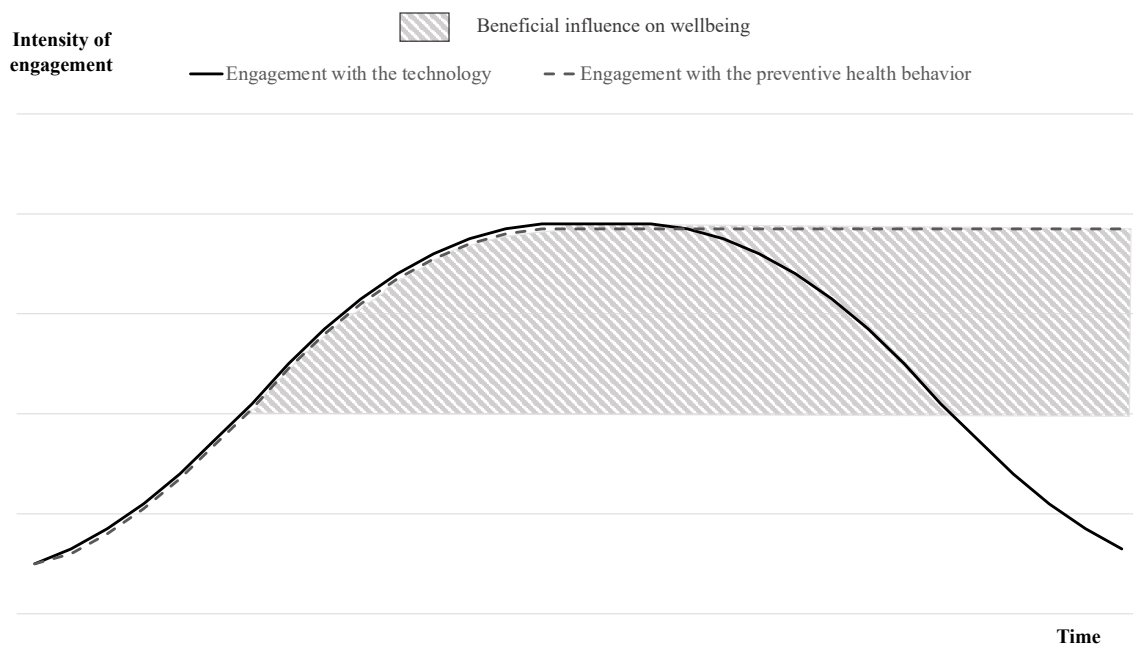
FIGURE 3 Engagement curve trajectory

As highlighted in the past paragraphs, consumers with a low need for data tend to engage with the PHT and/or the preventive health behavior in a moderate and sustained manner over time,

which mostly benefits their wellbeing. The PHT is regarded as a useful tool in their daily activities, on which they remain in control ("I'm using the app, the app is not using me. I'm the one deciding"; Respondent 25, male, age 17, calorie counter app). This leads us to formulate a first proposition:

P1: Consumers with a low need for data are inclined to engage with the PHT in a way that promotes long-term wellbeing.

4.2.3. Trajectory type 3: Detrimental over-engagement

For respondents with a high need for data using the technology as a functional tool to solve a preventive health problem (i.e., the problem-solver) or as a hedonic tool to maximize their performance (i.e., the performance optimizer), CE with the PHT can sometimes become obsessive, as the need to record, monitor and keep track of every aspect of the preventive health behavior becomes overpowering. When CE of this type occurs, the compulsion and obsession that consumers exhibit towards their PHT can end up eliciting extreme levels of CE and, thus, the occurrence of "over-engagement". In the case of highly functional goals, this compulsion can occur despite its negative effects on consumers' thoughts (e.g., self-denigration), emotions (e.g., guilt, self-loathing) and behaviors (e.g., negative comparison with others), as the following quote illustrates:

> As I was gradually making the efforts [to try and lose weight], I wouldn't see any difference [on the scale] and even sometimes, my weight would go up again. And so, I started to be obsessed with it [the connected scale and app]. I was weighing myself every day, I would go and check the app every day, to see if I had lost fat, gained muscle…. In the end, it's a bit bad for morale, to connect [to the app] all the time, to notice that I wasn't improving. It would make me feel depressed. That's a vicious circle, you know. *(Respondent 9, female, age 27, smart scale)*

This obsessive engagement can reach a point at which consumers forget about their own sensations and adopt extreme and dangerous behaviors to reach their (hedonic or functional) goals, such as eating too little food to keep their calories goal of the day in check or going for a run to reach their daily objective, even though they might feel sick or overly tired.

> In extreme cases, it got harmful as well. Because I was computing [the calories] for everything. And it can get addictive. For instance, in my personal experience, I was really following a very strict diet. When I was cooking, one gram of rice was really important for me, and if I got over the advised quantity, I would remove this one gram from what I was eating.… And these were meals that would always leave me a bit hungry. I was never starving but at the same time, I was not really full and satisfied neither. I was always waiting for the next planned meal. *(Respondent 4, male, age 31, calorie counter app)*

> When I received this Fitbit watch, I realized I wasn't walking enough, I was only doing like 6,000 steps a day, I think. And when I was reminded that I was not doing what was recommended [by the PHT; 10,000 steps a day] and the minimum that I should be doing, this really motivated me to walk more each day. But at the same time, it would just make me feel like I'm not sporty enough sometimes. […] And when I reach the objective [of 10,000 steps], I feel good, but also, I have some knee issues, and so each time I reach the goal, I feel pain in my knees. […] I could change the daily objective, but I think I'll leave the 10,000 steps because scientifically, it's the minimum that they say you should do… And if I change it, I know I'm not even going to try anymore. *(Respondent 23, female, age 16, smartwatch)*

FIGURE 4a Detrimental over-engagement trajectory

Furthermore, not only can this over-engagement result in fostering negative thoughts and emotions to consumers, but it can also lead to consumers restraining themselves from practicing the preventive health behavior altogether because of the negative affect that they anticipate will result from the PHT if they do so. In this case, the PHT seems to overly control the mindset of consumers to such an extent that they are taking extreme decisions based on the technology.

> When I know that I'm not feeling in really good shape, it [smartwatch] can also demotivate me [to go for a run], because I don't like to see bad performances. And I don't like for others to see them neither. But I cannot go for a run and not record it. I need to do it. Going for a run without my watch, even when I know that it's because I'm not in a very good shape and I just want to do it gently, it's impossible. I need to see my performances.… Sometimes, I feel like I have a mental block. *(Respondent 2, female, age 25, smartwatch)*
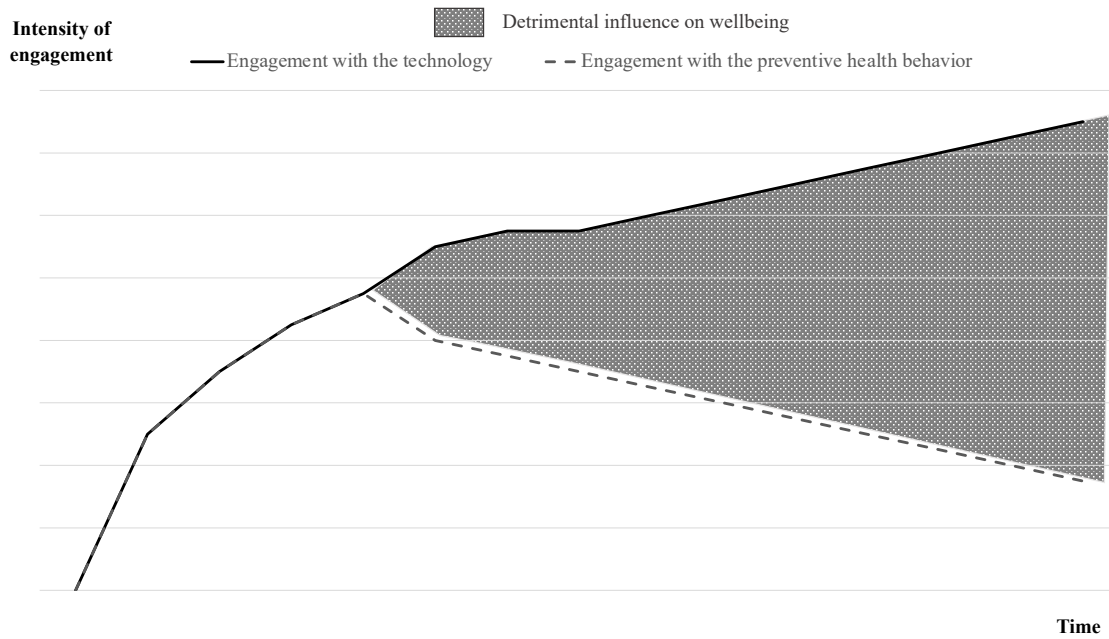
FIGURE 4b Detrimental technology over-engagement trajectory

Overall, given the intensity of the negative affect and emotions fostered in the over-engagement phase, the potential rejection of the preventive health behavior altogether and the compulsive behaviors encouraged, the over-engagement trajectory can lead to detrimental effects for the wellbeing of consumers (see Figures 4a and 4b). Accordingly, we propose:

P2: Consumers with a high need for data are inclined to engage with the PHT in a way that harms long-term wellbeing.

P3: Detrimental over-engagement can occur toward the preventive health behavior and/or toward compulsive technology usage.

4.2.4. Trajectory type 4: Bumpy engagement

Finally, the data reveal a last trajectory of CE with PHTs, which consists of a fluctuating path between low and high levels of engagement. In other words, consumers begin incrementally engaging with the PHT and then the engagement fades for some time; then, they engage again, repeating cycles of engagement followed by disengagement from the PHT. This last trajectory

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particularly emphasizes the changing relationship which exists between consumers and their health goals, directly influencing the evolution of their relationship with the PHT. For instance, these changing patterns can be due to the need to fulfil small functional goals that are repeated on a frequent basis, as the following quote illustrates:

> This app, I will really use it during definitive periods. Usually, when I start using it again, it's because I want to lose 2 or 3 kilos. And once it's done, I will usually keep on using it on a daily basis during 1 or 2 months, so that I can see that I've taken up good habits again. And then, around this time, I'll tell myself that I'm ok, it's been 2 months, I'm still at the weight I want, so I'll leave it aside. *(Respondent 6, female, age 24, calorie counter app)*

Another reason respondents mentioned for fluctuating levels of engagement is the need to disconnect from the tracking of the preventive behavior. Indeed, some reported a decrease in their perceived enjoyment of the preventive activity if they knew they were recording it, which led them to purposefully decide to leave the PHT aside for a while in specific contexts so that they could attend to a hedonic consumer health goal, as the following quote illustrates:

> If my app is on, I want to do a good performance. And so, by definition, I will try to push myself. Before, when I would go for a run with my partner, just for fun, we would go in the woods. And so, with him, we sometimes stopped or walked because the surroundings were nice. So, I think I was enjoying it [going for a run] more, because I had no objectives in mind.... And that's why when I go for a run with my partner in the woods or a nice place, I'm not taking the app with me. *(Respondent 19, female, age 24, running app)*

Finally, the context in which consumers find themselves—and more specifically, the ability to pursue the preventive health behavior targeted by the PHT—also pushes them to adopt varying levels of engagement with the technology over time. As we noted in the theoretical background, the context of PHTs inextricably links CE with the technology and engagement with the preventive behavior, which means that the inability to follow the healthy routine might affect the trajectories of engagement:

I was tracking everything more before. Because this year, I've started a year with lots of activities. I do less sports than last year and the year before that. So, I also use my watch less.… I still go for a run from time to time, I go cycling a little bit, but not as much as I was doing before. But when I'll start seriously again, for instance, during the summer holidays, I'll start using it [smartwatch] a lot more and interact with it as I was doing before. *(Respondent 7, male, age 19, smartwatch)*

Such changes in CE levels can be linked to a decrease in wellbeing, especially when CE with the PHT becomes extreme, when the preventive health behavior is set aside or when dissonance exists between CE with the PHT and the preventive health behavior. However, this decrease in wellbeing is not systematically the case, as consumers might decide to disengage with the technology because it does not seem useful at the time (e.g., they reached a short-term goal) rather than because they are experiencing negative thoughts and emotions fostered by their engagement. Consequently, the relationship between CE with the PHT and wellbeing will highly depend on the context in which consumers find themselves (see Figure 5). We accordingly posit:

P4: Evolving consumer goals manifest in fluctuating engagement patterns with PHTs, influencing both long-term wellbeing and illbeing.
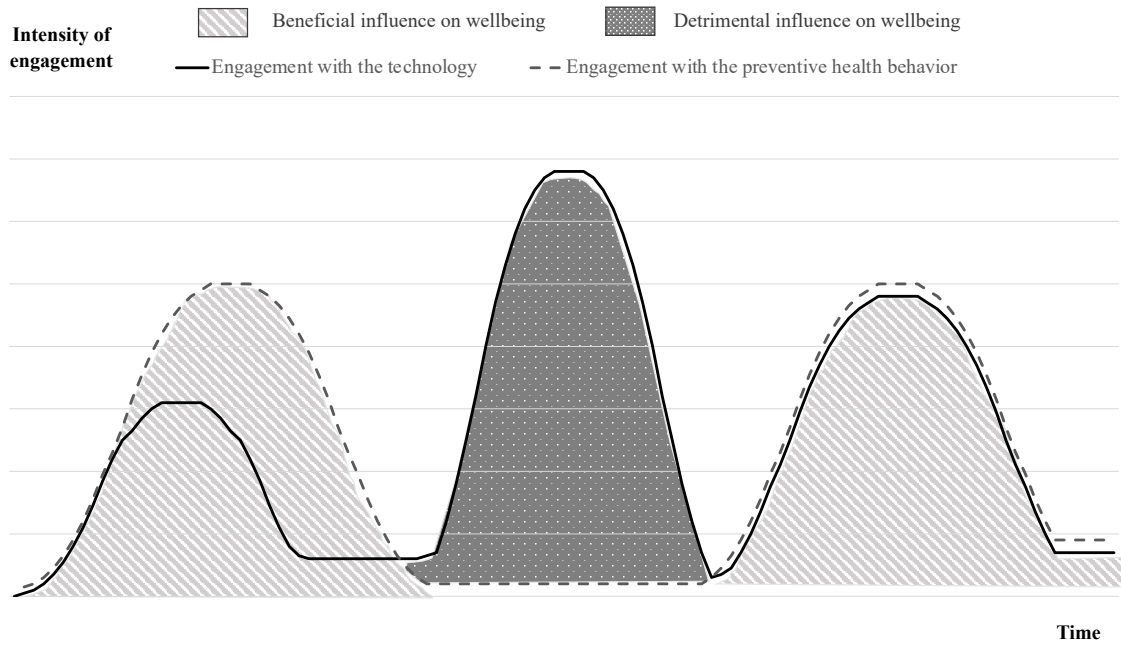
Intensity of engagement	▨ Beneficial influence on wellbeing	▨ Detrimental influence on wellbeing
	—— Engagement with the technology	- - Engagement with the preventive health behavior

Time

FIGURE 5 Bumpy engagement trajectory

5. DISCUSSION

This investigation sheds light on the relationship between CE with PHTs and consumer wellbeing, by focusing on the role of consumer health goals and engagement trajectories. More specifically, our data show that consumer health goals are crucial for shaping the intensity and valence of CE with PHTs. These findings concur with a nascent body of literature investigating PHTs that emphasizes the importance of individual goals *(*Canhoto and Arp, *2017;* Flaherty *et al.*, 2021). As CE is conceptualized as a motivational construct that depends on consumers' willingness to invest resources (Alkire *et al.*, 2022; Hollebeek *et al.*, 2019) and that varies depending on consumer characteristics (e.g., Dessart *et al.*, 2019); in this context, the major role of consumer health goals in the unfolding of CE with PHTs makes particular sense.

Furthermore, by showing that the matrix of consumer health goals results in contrasting CE trajectories, we strengthen findings suggesting that CE results in different consumer outcomes (O'Brien *et al.*, 2022), especially due to its motivational nature and individual differences. Consequently, we conclude that how CE unfolds will ultimately be shaped by individual and

contextual factors (Bowden *et al.*, 2015). Our data particularly show that differences in consumer health goals led to four trajectories of CE with PHTs. These findings advance recent studies showing that consumers can take various journeys when they engage with PHTs (Canhoto and Arp, 2017). More specifically, we find that dimensions of CE experienced by consumers influence one another, and specific combinations of dimensions working together affect the dynamism of the relationship with the PHT and its unfolding (Flaherty *et al.*, 2019).

The engagement trajectories introduced herein can help researchers understand the conditions under which CE with PHTs is beneficial or detrimental to consumer wellbeing, highlighting its potential to represent a double-edged sword for consumer wellbeing. Notably, consumer health goals that involve a lower need for data will tend to foster positively valenced dimensions of engagement and turn the technology into a key partner in the preventive health behavior, thus encouraging healthy routines as well as positive thoughts and affect, and ultimately leading to consumer wellbeing. By contrast, over-engagement and compulsion resulting from high need for data can foster an obsessive relationship with the PHT as well as overly negative thoughts and affect, which can be particularly detrimental for consumer wellbeing. This finding parallels other consumption contexts which can be detrimental to consumer wellbeing, such as excessive social media use (Zahrai *et al.*, 2022) or over-engagement with sports evolving into addictive practices (Dessart and Bressolles, 2022). For some consumers, PHT usage can thus evolve in maladaptive (Boland *et al.*, 2020) and mindless (Wang *et al.*, 2023) consumption, resulting in consumer illbeing.

This over-engagement and compulsion might be further strengthened by the never-ending improvement circle that PHTs tend to foster, in which consumers can always improve themselves and reach "a better self" (Batat and Hammedi, 2023). Overall, these results reinforce the growing belief that digital technologies aiming to keep consumers behaviorally engaged may end up negatively affecting their wellbeing (O'Brien *et al.*, 2022). In the case of PHTs,

technostress might be experienced through compulsion and obsession towards the technology (Kumar *et al.*, 2022), and can even impede engagement with the preventive health behavior fostered, showing that CE trajectories can contrast depending on various engagement objects working within the same ecosystem (Bowden *et al.*, 2017; O'Brien *et al.*, 2022).

Nevertheless, high levels of engagement toward PHTs might be beneficial for some consumers. Instead, over-engagement, conceptualized in this study as maladaptive interactions with the technology brought about by compulsive thoughts and behaviors, is conducive to illbeing among consumers.

This nuance can be explained by the COR theory (Hobfoll, 1989), according to which consumers engage with PHTs to retain, protect, and build resources—such as developing physiological aptitudes when customers use a fitness app to be fitter or enhancing physical attributes when customers use a nutrition app to follow a diet. When consumers observe that, thanks to their engagement with the PHT, they retain, protect, and develop their resources, they will likely experience wellbeing, even if this engagement is intense. For instance, a consumer who observes that they can run faster and longer is likely to experience feelings of wellbeing— as a result of observing their enhanced performance on the fitness app. Here, intensive engagement catalyzes positive behavioral change and enhanced wellbeing.

In contrast, the COR theory predicts that psychological distress, and thus, illbeing, is salient in threatening settings, such as when consumers feel a potential or actual threat of a net loss of resources. When over-engagement occurs, consumers may lose their ability to self-regulate and control their thoughts and behaviors toward the technology, which results in resource depletion—which might not always be accompanied by a gain of physical aptitudes (i.e., over-engagement with the technology might not lead to better physical performances). In the face of stressing information (e.g., bad physical performance), consumers become "decreasingly

capable of meeting the challenge, resulting in loss spirals" (Hobfoll *et al.*, 1996, p. 326), strengthening the compulsive effect of over-engagement and its detrimental impact on wellbeing.

In the end, CE with PHTs represents a double-edged sword for consumer wellbeing, enhancing vs. harming wellbeing depending on the individual consumer and their context (Bowden *et al.*, 2015; O'Brien *et al.*, 2022). These findings particularly concur with recent work showing how consumer quantification practices can both lead to wellbeing and illbeing, depending on individual and technological factors (Peterson *et al.*, 2021). Indeed, consumers' individual characteristics seem to dictate how CE with PHTs will unfold (Flaherty *et al.*, 2021), which will determine how their engagement influences their wellbeing.

5.1. Theoretical contributions

By exploring the relationship between CE with PHTs and wellbeing through consumer health goals and engagement trajectories, this study answers recent calls for research on the role of PHTs in fostering consumer wellbeing (Hollebeek and Belk, 2021; Lim *et al.*, 2022) and the key mechanisms explaining this relationship (Chen *et al.*, 2024). It further proposes a nuanced perspective (Donthu *et al.*, 2021; O'Brien *et al.*, 2022) by illustrating that CE with PHTs can be both beneficial and detrimental to consumer wellbeing, depending on the type of health goals pursued by the consumer and the resulting CE trajectories. By proposing a matrix of consumer health goals, we particularly emphasize the importance of consumers' evolving motivations and experience with the PHT (Peterson *et al.*, 2021), considering the co-existence of multiple and sometimes interrelated goals (Mwangi *et al.*, 2024). Such evolving goals foster consumption experiences that will result either in enhanced wellbeing, or in illbeing and maladaptive consumption (Boland *et al.*, 2020), emphasizing the paradox brought about by technology use (Yap *et al.*, 2021).

In addition, our study contributes to the CE literature as it illustrates the dynamic nature of the engagement process (Jaakkola and Alexander, 2024) through a typology of engagement trajectories in the context of PHTs, also highlighting contrasting CE levels and valences for engagement objects working within the same ecosystem (Bowden *et al.*, 2017; O'Brien *et al.*, 2022). This research focuses on currently overlooked aspects in the CE literature, such as varying engagement levels, contrasting engagement dimensions and extreme engagement states (i.e., disengagement and over-engagement) (Naumann *et al.*, 2020; O'Brien *et al.*, 2022). In addition to substantively expanding the concept of CE within the context of PHTs, the knowledge advanced herein can also be transferable to other domains in which over-engagement tends to occur and jeopardize wellbeing, such as social media (Okazaki *et al.*, 2021; Zahrai *et al.*, 2022) and work (Nickum and Desrumaux, 2022).

Finally, our research expands the literature on PHTs as we go beyond positivist investigations on technology adoption and usage (e.g., Huang and Ren, 2020; Yousaf *et al*., 2021) and consider how CE with PHTs unfolds and how consumers actually experience it in terms of wellbeing. This research also takes a broader perspective of PHTs by including any health technology targeted at preventive health, in contrast with extant studies, which tend to investigate a specific application, such as physical activity. This comprehensive approach allows us to draw extensive conclusions about the trajectories of CE with PHTs and their role in consumer wellbeing, emphasizing their pivotal role as key triggers of contrasting wellbeing outcomes (Chen *et al.*, 2024).

5.2. Practical implications

This research has implications for PHT companies, especially as design plays a key role in technology addiction (Berthin *et al.*, 2019; Cemiloglu *et al.*, 2022). Overall, our insights show that though PHTs are often considered a tool to help consumers in their quest for wellbeing

(Sweeney *et al.*, 2015), over-engagement with the technology can occur with detrimental consequences for consumers. Accordingly, technology developers should take a step back and reflect on the meaningfulness of highly engaging consumers with PHTs, especially when over-engagement does not result in positive consumer outcomes (O'Brien *et al.*, 2022). In this regard, meaningful support for the preventive health behavior should be promoted, as well as adaptive usage levels of PHTs (Boland *et al.*, 2020), instead of techniques fostering compulsive and obsessive engagement with the technology itself.

Given the potential of PHTs to be highly detrimental, designers should mitigate potential negative CE manifestations through a personalized technology design, considering, for example, potential patterns expressed by consumers while engaging. The PHT might make use of an overly supportive and benevolent tone and design when dealing with consumers with a high need for data, rather than popular tools promoting achievement and success. For instance, Shape by Fabulous[2] is a diet app which not only focuses on daily calories goal and weight loss. Instead, the app offers coaching on intuitive eating, with the overall aim of "befriending your body" by considering hunger and satiety cues. The app focuses on awareness regarding the preventive health behavior, rather than deprivation, to reach a specific goal.

The technology could also detect patterns of over-engagement and implement potential pathways to help consumers detach from compulsive patterns and fall back into a moderate relationship with the PHT and preventive behavior (for instance, notifications encouraging to rest: "You have already run 3 times this week, have you thought about giving it a rest today?" or "Treat yourself today, food for the heart is also important"). Managers could also enable consumers to customize their prompts and notification frequency when they start using PHTs. This customization ensures that prompts align with each individual's needs. Over time, these

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2 https://www.thefabulous.co/shape/

prompts can be adjusted based on consumer data. For instance, if a pattern of high need for data is detected, the technology can suggest changing prompts to be more supportive or less frequent to prevent over-engagement.

Finally, as technologies sometimes foster social comparison, which can be detrimental to consumer wellbeing (Okazaki *et al.*, 2021), the promotion of social features within PHTs might be reduced for some users particularly at risk (e.g. teenagers). More specifically, passive users of communities within PHTs might show low engagement toward the preventive health behavior (or even disengagement) but high engagement toward social media mechanisms of the technology. This should cue PHT designers that a detrimental social comparison is at place (Verduyn *et al.*, 2020), which does not result in wellbeing for the consumers. In these specific cases, consumers need to be reminded of the initial objective of the PHT (i.e., the promotion of preventive health behaviors), as well as the potential "fakeness" of social media, as users tend to present information about themselves that are particularly self-enhancing (Gil-or *et al.*, 2015).

From a societal perspective, this research advances knowledge on the challenges that represent technology addiction and over-consumption (Berthon *et al.*, 2019), and their detrimental effect on consumer wellbeing. Our research suggests that PHT experiences can become compulsive for some consumers, up to the detriment of their own wellbeing. In this sense, PHTs currently make use of consumer data to foster engagement levels which can result in individual illbeing. Unfortunately, as companies usually aim to keep users on the PHT for as long as possible (Berthon *et al.*, 2019), their interests might be clashing with those of the consumers. Particularly, consumers showcasing a high need for data are more vulnerable in the way they cope with their PHT and would therefore benefit from heightened attention. These insights also echo the technology paradox (Yap *et al.*, 2021) which can be brought about by PHTs, as they foster both wellbeing and illbeing for different consumers—or for the same individual at

different points in time. This study particularly confronts this paradox in PHT engagement by highlighting how contrasting profiles of consumers reach different wellbeing levels through their use of the technology.

5.3. Policy implications

Interactions between marketing research and public policy would benefit policymakers in their efforts to support consumer wellbeing (Billore *et al.*, 2023). The insights from this research thus hold significant implications for policymakers.

First, the growing innovative modalities of PHTs lead to a new era for biomonitoring and the quantified-self movement (McKinsey, 2024), offering an expanded array of health indicators and personal data for individual consumers. For instance, wearable biometric rings, like the Oura Ring, now track sleep quality, stress levels, and ovulation states, amongst others. These advancements result in an excess of data available to consumers, sometimes leading to adverse effects on wellbeing due to an intense focus on data. While self-tracking technologies like PHTs often place the responsibility on consumers to manage their digital usage and avoid over-engagement, the design and features of these devices also play a significant role, enticing compulsive usage (Cemiloglu *et al.*, 2022). Thus, government scrutiny of PHTs is crucial. Regulations should address the type of data collected and features designed to engage users. Specifically, PHTs should be mandated to incorporate explanations and tools within their design to empower users to use self-tracking technologies responsibly.

Second, fostering the growth and development of young consumers, who represent the future of society, requires collective effort (Billore *et al.*, 2023). Recent statistics (e.g., McKinsey, 2024) indicate that young consumers, including Generation Z, are keenly interested in improving their wellness and health through PHTs and related services. However, they also face a greater susceptibility to developing digital addiction and maladaptive technology usage

behaviors (Lozano-Blasco *et al.*, 2022). Therefore, it is imperative to implement prevention and education approaches that empower young consumers to exert greater control over their digital habits (Cemiloglu *et al.*, 2022). In countries like South Korea, where technology penetration is high, the legislation mandates schools and public institutions to conduct prevention training campaigns targeting digital addiction and compulsive technology usage (Cho, 2016).

Consequently, public policy interventions should mitigate consumers' tendencies towards maladaptive technology behaviors, especially among young individuals. These interventions should offer practical lessons and guidelines to promote mindful technology usage (Wang *et al.*, 2023). Central to this effort is enhancing young people's self-regulation resources, which enable them to manage impulses and regulate their behaviors (Billore *et al*., 2023; Matthes *et al.*, 2022). For example, school-based preventive interventions could equip young consumers with coping strategies to navigate internal and external triggers challenging impulse control, such as meditation and cognitive-behavioral therapy approaches.

Social comparison, fueled by widespread social media usage, especially among young consumers (Verduyn *et al.*, 2020), also affects engagement with PHTs. These technologies often integrate social media features, facilitating connection and motivation and fostering unfavorable comparisons: for instance, self-tracking technologies such as Strava fosters the comparison of one's physical performance with other members' performance. Exposure to idealized content on social media platforms can undermine self-esteem (Verduyn *et al.*, 2020). Our research suggests that this process of comparison can even deter users from healthy behaviors, as they fear a misalignment of their actual and ideal performance, leading to feelings of inferiority. Paradoxically, these self-tracking technologies perpetuate unfavorable comparisons, worsening wellbeing. To address this public health issue of problematic use of self-tracking technologies, prevention campaigns promoting self-regulation and the risks of

such technologies together with social media are crucial, particularly for vulnerable demographics like young individuals with a high need for data.

5.4. Limitations and future research suggestions

Although the exploratory setting of this research enabled us to uncover deep insights regarding CE with PHTs and its role in consumer wellbeing, it nevertheless presents several limitations that suggest fruitful avenues for future research. In Table 4, we provide specific avenues for future research along four key dimensions (i.e., consumer-related factors, technology-related factors, engagement trajectories, and wellbeing outcomes) to guide scholars in better understanding CE with PHTs and its relationship with consumer wellbeing.

Dimension	Avenues for future research
Consumer-related factors	- What specific vulnerability factors contribute to the adoption of a high need for data orientation approach in PHTs? - How do consumers with a high need for data differ in their perception and interaction with PHTs compared to those with a low need for data? - To what extent do individual characteristics (i.e., age, gender, cultural norms, societal factors, personality traits, etc.) influence the relationship between consumers' need for data and their engagement with PHTs? - How do discrepancies between consumers' actual and ideal self-perceptions impact their need for data in the context of PHTs? - How do self-presentation motives influence the engagement patterns of consumers, and how does this relate to their self-esteem?
Technology-related factors	- What specific features of PHTs contribute to fostering a high need for data among users? - How do the design and presentation of information in PHTs contribute to the detrimental patterns of engagement among consumers with a high need for data? - In what ways does information overload from PHTs impact the engagement patterns and wellbeing outcomes of consumers with a high need for data? - How does exposure to social comparison features within PHTs influence the engagement patterns and wellbeing of consumers with a high need for data?
Engagement trajectories	- What factors contribute to consumers maintaining a low or high need for data throughout their usage of PHTs? - Which factors (contextual, personal, etc.) influence PHT users to develop evolving goals in their relationship with the technology over time? - What other variables play a role in influencing consumers' levels of engagement toward PHTs over time?
Wellbeing outcomes	- In which ways does engagement with PHTs influence consumer stress levels, and what is the resulting impact on overall wellbeing? - In which ways does engagement with PHTs influence consumer self-esteem, and what is the resulting impact on overall wellbeing? - How do the concepts of value co-creation and co-destruction explain the relationship between engagement with PHTs and the contrasting wellbeing outcomes experienced by consumers?

TABLE 4 Future research avenues

First, consumers' characteristics seem to influence how CE with PHTs will unfold (Flaherty *et al.*, 2021), which can determine how their engagement influences their wellbeing. While consumer health goals are introduced as a relevant avenue to explain why CE with PHTs both might be beneficial and detrimental to consumer wellbeing, other individual characteristics might be at play (e.g., gender, age) and could not be further explored in the scope of this study. For instance, young women seem to be more at risk of developing maladaptive behaviors when engaging with PHTs, mainly because of their deeper concerns regarding physical appearance

(Chen *et al.*, 2024). Similarly, future research might examine specific personality traits that influence the conditions under which CE is detrimental to consumer wellbeing. Notably, consumers' perceived self-image (Batat and Hammedi, 2023) or mindfulness traits (Wang *et al.*, 2023) could also affect their engagement with PHTs, which could further explain why this engagement can jeopardize consumer wellbeing in some instances. Furthermore, more research is needed to understand better the underlying reasons that push consumers to adopt a high need for data toward a PHT, as well as the compulsive over-engagement that might follow.

Second, the study design enabled us to holistically apprehend the context of PHTs without limiting our findings to specific devices or healthy behaviors. However, our research questions did not account for the role of technology design in fostering consumer wellbeing through CE with PHTs despite the importance of technological factors in influencing engagement (Peterson *et al.*, 2021) and its role in consumer wellbeing (Chen *et al.*, 2024). Notably, as most PHT use gamification to foster CE with challenging routines (Koivisto and Hamari, 2019), the role of gamification in the relationship between CE and wellbeing warrants further research. Furthermore, social media mechanisms such as social comparison, self-enhancement, and manipulated self-presentation also represent an important research area to investigate.

Third, while we explore consumer health goals as a critical mechanism in explaining different trajectories of CE with PHTs, we believe that other variables play a role in influencing consumers' levels of engagement toward PHTs over time. Thus, it is essential for future research to investigate other variables influencing engagement trajectories (Chen *et al.*, 2024; Mwangi *et al.*, 2024), such as personal and contextual factors leading consumers to adopt evolving and contrasting goals regarding their PHT use over time.

Fourth, this study apprehended wellbeing through respondents' subjective assessments of thoughts and emotions revolving around their engagement with PHTs (Ryan and Deci, 2001).

Nevertheless, other facets of consumer wellbeing might be influenced by CE with PHTs, which pave the way for fruitful future research (Chen *et al.*, 2024). For instance, several studies call for more research on the link between engagement with new technologies and stress (e.g., Hollebeek and Belk, 2021; Hollebeek *et al.*, 2023), which might influence overall wellbeing if experienced over a prolonged period of time. Moreover, because PHTs encourage individuals to connect strongly with themselves through data, they highly contribute to developing consumers' self-concept (e.g., Alkire *et al*., 2022). Accordingly, future research could focus on the relationship between CE with PHTs and self-esteem and how it contributes to consumer wellbeing. Further, engagement serves as a key driver of value co-creation and co-destruction (Echeverri and Skålén, 2021; Jaakkola and Alexander, 2014). Given that our study links CE with both beneficial and detrimental wellbeing outcomes, future research should explore these dynamics further, using value co-creation and co-destruction as theoretical frameworks to better understand this dual impact on different consumer segments.

Finally, the exploratory nature of this research allowed for the discovery of novel insights. However, in-depth interviews also brought inherent limitations such as self-reported, recall, and social desirability bias. Yet, to keep these biases minimal, the researchers built rapport with participants from initial contact and emphasized the importance of individual experiences over specific answers during interviews. Additionally, prompts during interviews focused on temporal changes in participants' relationships with PHTs, and respondents were encouraged to reflect on their behavioral data. Nevertheless, the findings presented in this paper remain exploratory, and future research should aim to test them using quantitative and longitudinal techniques, such as experiments and the analysis of behavioral data.

REFERENCES

Akdevelioglu, D., Hansen, S., and Venkatesh, A. (2022) Wearable technologies, brand community and the growth of a transhumanist vision. *Journal of Marketing Management,* 38(5-6), 569-604. Available at: https://doi.org/10.1080/0267257X.2021.2001559

Alkire, L., Myrden, S., Köcher, S., and O'Connor, G. E. (2022) Cultural drivers of health engagement. *Journal of International Marketing*, 31(1), 90-105. Available at: https://doi.org/10.1177/1069031X221127938

Batat, W., and Hammedi, W. (2023) The extended reality technology (ERT) framework for designing customer and service experiences in phygital settings: A service research agenda. *Journal of Service Management*, 34(1), 10–33. Available at: https://doi.org/10.1108/JOSM-08-2022-0289

Beldad, A. D., and Hegner, S. M. (2018) Expanding the technology acceptance model with the inclusion of trust, social influence, and health valuation to determine the predictors of German users' willingness to continue using a fitness app: A structural equation modeling approach. *International Journal of Human–Computer Interaction*, 34(9), 882–893. Available at: https://doi.org/10.1080/10447318.2017.1403220

Berthon, P., Pitt, L., and Campbell, C. (2019) Addictive de-vices: A public policy analysis of sources and solutions to digital addiction. *Journal of Public Policy & Marketing*, 38(4), 451-468. Available at: https://doi.org/10.1177/0743915619859852

Billore, S., Anisimova, T., and Vrontis, D. (2023) Self-regulation and goal-directed behavior: A systematic literature review, public policy recommendations, and research agenda. *Journal of Business Research*, 156, 113435. Available at: https://doi.org/10.1016/j.jbusres.2022.113435

Birkmeyer, S., Wirtz, B. W., and Langer, P. F. (2021) Determinants of mHealth success: An empirical investigation of the user perspective. *International Journal of Information Management*, 59, 102351. Available at: https://doi.org/10.1016/j.ijinfomgt.2021.102351

Blumler, J. G., and Katz, E. (Eds.) (1974) The Uses of Mass Communications: Current Perspectives on Gratifications Research. In: *Sage Annual Reviews of Communication Research*, Volume III. Beverly Hills, California.

Bol, N., Helberger, N., and Weert, J. C. M. (2018) Differences in mobile health app use: A source of new digital inequalities? *The Information Society*, 34(3), 183–193. Available at: https://doi.org/10.1080/01972243.2018.1438550

Boland, W. A., Martin, I. M., and Mason, M. J. (2020) In search of well-being: factors influencing the movement toward and away from maladaptive consumption. *Journal of Consumer Affairs*, 54(4), 1178-1194. Available at: https://doi.org/10.1111/joca.12324

Bowden, J. L. H., Gabbott, M., and Naumann, K. (2015) Service relationships and the customer disengagement–engagement conundrum. *Journal of Marketing Management*, 31(7–8), 774–806. Available at: https://doi.org/10.1080/0267257X.2014.983143

Bowden, J. L.-H., Conduit, J., Hollebeek, L. D., Luoma-aho, V., and Solem, B. A. (2017) Engagement valence duality and spillover effects in online brand communities. *Journal of Service Theory and Practice*, 27(4), 877–897. Available at: https://doi.org/10.1108/JSTP-04-

2016-0072

Braun, V., and Clarke, V. (2006) Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. Available at: https://doi.org/10.1191/1478088706qp063oa

Brodie, R. J., Hollebeek, L. D., Jurić, B., and Ilić, A. (2011) Customer engagement: Conceptual domain, fundamental propositions, and implications for research. *Journal of Service Research*, 14(3), 252–271. Available at: https://doi.org/10.1177/1094670511411703

Canhoto, A. I., and Arp, S. (2017) Exploring the factors that support adoption and sustained use of health and fitness wearables. *Journal of Marketing Management*, 33(1–2), 32–60. Available at: https://doi.org/10.1080/0267257X.2016.1234505

Capito, S., and Pergelova, A. (2023) Treat yourself: Food delivery apps and the interplay between justification for use and food well-being. *Journal of Consumer Affairs*, 57(1), 479-506. Available at: https://doi.org/10.1111/joca.12507

Cemiloglu, D., Almourad, M. B., McAlaney, J., and Ali, R. (2022) Combatting digital addiction: Current approaches and future directions. *Technology in Society*, 68, 101832. Available at: https://doi.org/10.1016/j.techsoc.2021.101832

Chan, S. S., Van Solt, M., Cruz, R. E., Philp, M., Bahl, S., Serin, N., ... and Canbulut, M. (2022) Social media and mindfulness: From the fear of missing out (FOMO) to the joy of missing out (JOMO). *Journal of Consumer Affairs*, 56(3), 1312-1331. Available at: https://doi.org/10.1111/joca.12476

Chatzopoulou, E., Filieri, R., and Dogruyol, S. A. (2020) Instagram and body image: Motivation to conform to the "Instabod" and consequences on young male wellbeing. *Journal of Consumer Affairs*, 54(4), 1270-1297. Available at: https://doi.org/10.1111/joca.12329

Chen, C.-C., Hsiao, K.-L., and Li, W.-C. (2020) Exploring the determinants of usage continuance willingness for location-based apps: A case study of bicycle-based exercise apps. *Journal of Retailing and Consumer Services*, 55, 102097. Available at: https://doi.org/10.1016/j.jretconser.2020.102097

Chen, H., Schoefer, K., Manika, D., and Tzemou, E. (2024) The "Dark Side" of General Health and Fitness-Related Self-Service Technologies: A Systematic Review of the Literature and Directions for Future Research. *Journal of Public Policy & Marketing, 43*(2), 151-170. Available at: https://doi.org/10.1177/07439156231224731

Cheung, M. L., Chau, K. Y., Lam, M. H. S., Tse, G., Ho, K. Y., Flint, S. W., Broom, D. R., Tso, E. K. H., and Lee, K. Y. (2019) Examining consumers' adoption of wearable healthcare technology: The role of health attributes. *International Journal of Environmental Research and Public Health*, 16(13), 2257. Available at: https://doi.org/10.3390/ijerph16132257

Chiu, W., Cho, H., and Chi, C. G. (2021) Consumers' continuance intention to use fitness and health apps: An integration of the expectation–confirmation model and investment model. *Information Technology & People*, 34(3), 978–998. Available at: https://doi.org/10.1108/ITP-09-2019-0463

Cho, C. (2016) South Korea's efforts to prevent internet addiction. In Israelashvili, M., and Romano, J.L. (Eds.) *The Cambridge Handbook of International Prevention Science.*

Cambridge University Press, pp. 551-573.

Corbin, J. M., and Strauss, A. L. (2015) *Basics of qualitative research: Techniques and procedures for developing grounded theory*, 4th edition. Thousand Oaks, California: SAGE Publications, Inc.

Cruz-Cárdenas, J., Zabelina, E., Guadalupe-Lanas, J., Palacio-Fierro, A., and Ramos-Galarza, C. (2021) COVID-19, consumer behavior, technology, and society: A literature review and bibliometric analysis. *Technological Forecasting and Social Change*, 173, 121179. Available at: https://doi.org/10.1016/j.techfore.2021.121179

Dessart, L., Aldás-Manzano, J., and Veloutsou, C. (2019) Unveiling heterogeneous engagement-based loyalty in brand communities. *European Journal of Marketing*, 53(9), 1854–1881. Available at: https://doi.org/10.1108/EJM-11-2017-0818

Dessart, L., and Bressolles, G. (2022) Intensity of collective consumption practices in brand communities: The case of Crossfit. *Journal of Brand Management,* 30, 227-244. Available at: https://doi.org/10.1057/s41262-022-00298-2

Diener, E., and Emmons, R. A. (1984) The independence of positive and negative affect. *Journal of Personality and Social Psychology*, 47(5), 1105–1117. Available at: https://doi.org/10.1037/0022-3514.47.5.1105

Do, D. K. X., Rahman, K., and Robinson, L. J. (2020) Determinants of negative customer engagement behaviours. *Journal of Services Marketing,* 34(2), 117-135. Available at: https://doi.org/10.1108/JSM-02-2019-0050

Donthu, N., Kumar, S., Pattnaik, D., and Lim, W. M. (2021) A bibliometric retrospection of marketing from the lens of psychology: Insights from *Psychology & Marketing. Psychology & Marketing*, 38(5), 834–865. Available at: https://doi.org/10.1002/mar.21472

Dubois, A., and Gadde, L. E. (2002) Systematic combining: an abductive approach to case research. *Journal of Business Research*, 55(7), 553-560. Available at: https://doi.org/10.1016/S0148-2963(00)00195-8

Echeverri, P., and Skålén, P. (2021) Value co-destruction: Review and conceptualization of interactive value formation. *Marketing theory,* 21(2), 227-249. Available at: https://doi.org/10.1177/1470593120983390

Fischer, E., and Guzel, G. T. (2023) The case for qualitative research. *Journal of Consumer Psychology*, 33(1), 259–272. Available at: https://doi.org/10.1002/jcpy.1300

Flaherty, S. J., McCarthy, M. B., Collins, A. M., and McAuliffe, F. M. (2019) A different perspective on consumer engagement: Exploring the experience of using health apps to support healthier food purchasing. *Journal of Marketing Management*, 35(3–4), 310–337. Available at: https://doi.org/10.1080/0267257X.2019.1576756

Flaherty, S. J., McCarthy, M., Collins, A. M., McCafferty, C., & McAuliffe, F. M. (2021) Exploring engagement with health apps: The emerging importance of situational involvement and individual characteristics. *European Journal of Marketing*, 55(13), 122–147. Available at: https://doi.org/10.1108/EJM-06-2019-0531

Gil-Or, O., Levi-Belz, Y., and Turel, O. (2015) The "Facebook-self": Characteristics and psychological predictors of false self-presentation on Facebook. *Frontiers in psychology*, 6, 99. Available at: https://doi.org/10.3389/fpsyg.2015.00099

Guest, G., Bunce, A., and Johnson, L. (2006) How many interviews are enough? An experiment with data saturation and variability. *Field methods,* 18(1), 59-82. Available at: https://doi.org/10.1177/1525822X0527990

Grodal, S., Anteby, M., and Holm, A. L. (2021) Achieving rigor in qualitative analysis: The role of active categorization in theory building. *Academy of Management Review*, 46(3), 591–612. Available at: https://doi.org/10.5465/amr.2018.0482

Hammedi, W., Leclercq, T., Poncin, I., and Alkire (Née Nasr), L. (2021) Uncovering the dark side of gamification at work: Impacts on engagement and well-being. *Journal of Business Research*, 122, 256–269. Available at: https://doi.org/10.1016/j.jbusres.2020.08.032

Hazée, S., Delcourt, C., and Van Vaerenbergh, Y. (2017) Burdens of access: understanding customer barriers and barrier-attenuating practices in access-based services. *Journal of Service Research,* 20(4), 441-456. Available at: https://doi.org/10.1177/1094670517712877

Henkens, B., Verleye, K., and Larivière, B. (2021) The smarter, the better?! Customer well-being, engagement, and perceptions in smart service systems. *International Journal of Research in Marketing*, 38(2), 425–447. Available at: https://doi.org/10.1016/j.ijresmar.2020.09.006

Hobfoll, S. E. (1989) Conservation of resources: A new attempt at conceptualizing stress. *American Psychologist*, 44(3), 513–524. Available at: https://doi.org/10.1037/0003-066X.44.3.513

Hobfoll, S. E., Freedy, J. R., Green, B. L., and Solomon, S. D. (1996) Coping in reaction to extreme stress: The roles of resource loss and resource availability. In Zeidner, M. and Endler, M.S. (Eds.) *Handbook of coping: Theory, research, applications.* New York: Wiley, pp. 322–349.

Hollebeek, L., Srivastava, R. K., and Chen, T. (2019) S-D logic–informed customer engagement: Integrative framework, revised fundamental propositions, and application to CRM. *Journal of the Academy of Marketing Science*, 47(1), 161–185. Available at: https://doi.org/10.1007/s11747-016-0494-5

Hollebeek, L., and Belk, R. (2021) Consumers' technology-facilitated brand engagement and wellbeing: Positivist TAM/PERMA- vs. Consumer Culture Theory perspectives. *International Journal of Research in Marketing*, 38(2), 387–401. Available at: https://doi.org/10.1016/j.ijresmar.2021.03.001

Hollebeek, L., Sharma, T. G., Pandey, R., Sanyal, P., and Clark, M. K. (2022) Fifteen years of customer engagement research: A bibliometric and network analysis. *Journal of Product & Brand Management*, 31(2), 293–309. Available at: https://doi.org/10.1108/JPBM-01-2021-3301

Hollebeek, L. D., Hammedi, W., and Sprott, D. E. (2023) Consumer engagement, stress, and conservation of resources theory: A review, conceptual development, and future research agenda. *Psychology & Marketing*, 40(5), 926-937. Available at:

https://doi.org/10.1002/mar.21807

Holmlund, M., Witell, L., and Gustafsson, A. (2020) Getting your qualitative service research published. *Journal of Services Marketing*, 34(1), 111-116. Available at: https://doi.org/10.1108/JSM-11-2019-0444

Huang, G., and Ren, Y. (2020) Linking technological functions of fitness mobile apps with continuance usage among Chinese users: Moderating role of exercise self-efficacy. *Computers in Human Behavior*, 103, 151–160. Available at: https://doi.org/10.1016/j.chb.2019.09.013

Jaakkola, E., and Alexander, M. (2014) The role of customer engagement behavior in value co-creation: A service system perspective. *Journal of Service Research*, 17(3), 247-261. Available at: https://doi.org/10.1177/1094670514529187

Jaakkola, E., & Alexander, M. (2024). Understanding and managing engagement journeys. *Journal of Service Management*, 35(3), 357-380. Available at: https://doi.org/10.1108/JOSM-02-2024-0066

Javornik, A., Marder, B., Barhorst, J. B., McLean, G., Rogers, Y., Marshall, P., and Warlop, L. (2022). "What lies behind the filter?" Uncovering the motivations for using augmented reality (AR) face filters on social media and their effect on well-being. *Computers in Human Behavior*, 128, 107126. Available at: https://doi.org/10.1016/j.chb.2021.107126

Kahneman, D., Diener, E., and Schwarz, N. (Eds.) (1999) *Well-being: The foundations of hedonic psychology*. New York: Russell Sage Foundation.

Kim, M. (2021) Conceptualization of e-servicescapes in the fitness applications and wearable devices context: Multi-dimensions, consumer satisfaction, and behavioral intention. *Journal of Retailing and Consumer Services*, 61, 102562. Available at: https://doi.org/10.1016/j.jretconser.2021.102562

Koivisto, J., and Hamari, J. (2019) The rise of motivational information systems: A review of gamification research. *International Journal of Information Management*, 45, 191-210. Available at: https://doi.org/10.1016/j.ijinfomgt.2018.10.013

Kumar, V., Rajan, B., Gupta, S., and Pozza, I. D. (2019) Customer engagement in service. *Journal of the Academy of Marketing Science*, 47(1), 138–160. Available at: https://doi.org/10.1007/s11747-017-0565-2

Kumar, V., Rajan, B., Salunkhe, U., and Joag, S. G. (2022) Relating the dark side of new-age technologies and customer technostress. *Psychology & Marketing*, 39(12), 2240-2259. Available at: https://doi.org/10.1002/mar.21738

Leisure Opportunities. (2021) *71,000 new health and fitness apps launched in 2020, estimates App Annie report*. Available at: https://www.leisureopportunities.co.uk/news/71000-new-health-and-fitness-apps-launched-in-2020-estimates-App-Annie-report/347246 [Accessed 27 June 2024]

Lee, S. Y., and Lee, K. (2018) Factors that influence an individual's intention to adopt a wearable healthcare device: The case of a wearable fitness tracker. *Technological Forecasting and Social Change*, 129, 154–163. Available at: https://doi.org/10.1016/j.techfore.2018.01.002

Lim, W. M., Rasul, T., Kumar, S., and Ala, M. (2022) Past, present, and future of customer engagement. *Journal of Business Research*, 140, 439–458. Available at: https://doi.org/10.1016/j.jbusres.2021.11.014

Lin, F., and Windasari, N. A. (2019) Continued use of wearables for wellbeing with a cultural probe. *The Service Industries Journal*, 39(15–16), 1140–1166. Available at: https://doi.org/10.1080/02642069.2018.1504924

Locke, E. A., and Latham, G. P. (2006) New directions in goal-setting theory. *Current directions in psychological science,* 15(5), 265-268. Available at: https://doi.org/10.1111/j.1467-8721.2006.00449.x

Locke, K., Feldman, M., and Golden-Biddle, K. (2022) Coding practices and iterativity: Beyond templates for analyzing qualitative data. *Organizational Research Methods*, 25(2), 262–284. Available at: https://doi.org/10.1177/1094428120948600

Lozano-Blasco, R., Robres, A. Q., and Sánchez, A. S. (2022) Internet addiction in young adults: A meta-analysis and systematic review. *Computers in Human Behavior*, 130, 107201. Available at: https://doi.org/10.1016/j.chb.2022.107201

Mason, J. (2017) *Qualitative researching*. London: Sage Publications.

McKinsey. (2024) *The trends defining the $1.8 trillion global wellness market in 2024.* Available at: https://www.mckinsey.com/industries/consumer-packaged-goods/our-insights/the-trends-defining-the-1-point-8-trillion-dollar-global-wellness-market-in-2024 [Accessed 27 June 2024].

Morgan-Thomas, A., Dessart, L., and Veloutsou, C. (2020) Digital ecosystem and consumer engagement: A socio-technical perspective. *Journal of Business Research*, 121, 713–723. Available at: https://doi.org/10.1016/j.jbusres.2020.03.042

Mwangi, V. N., Millard, R., and Histon, W. (2024) Prevalent elements of consumer wellbeing in wearable technology use: An interdisciplinary systematic review and future research agenda. *Psychology & Marketing*, 41(5), 1006-1021. Available at: https://doi.org/10.1002/mar.21962

Naumann, K., Bowden, J., and Gabbott, M. (2020) Expanding customer engagement: The role of negative engagement, dual valences and contexts. *European Journal of Marketing*, 54(7), 1469–1499. Available at: https://doi.org/10.1108/EJM-07-2017-0464

Nickum, M., and Desrumaux, P. (2022) Burnout among lawyers: Effects of workload, latitude and mediation via engagement and over-engagement. *Psychiatry, Psychology and Law*, 1–13. Available at: https://doi.org/10.1080/13218719.2022.2035840

O'Brien, H. L., Roll, I., Kampen, A., and Davoudi, N. (2022) Rethinking (dis)engagement in human-computer interaction. *Computers in Human Behavior*, 128, 107109. Available at: https://doi.org/10.1016/j.chb.2021.107109

Okazaki, S., Schuberth, F., Tagashira, T., and Andrade, V. (2021) Sneaking the dark side of brand engagement into Instagram: The dual theory of passion. *Journal of Business Research*, 130, 493–505. Available at: https://doi.org/10.1016/j.jbusres.2019.11.028

Peterson Fronczek, L., Mende, M., and Scott, M. L. (2022) From self-quantification to self-

objectification? Framework and research agenda on consequences for well-being. *Journal of Consumer Affairs*, 56(3), 1356-1374. Available at: https://doi.org/10.1111/joca.12478

Pitardi, V., and Marriott, H. R. (2021) Alexa, she's not human but… Unveiling the drivers of consumers' trust in voice-based artificial intelligence. *Psychology & Marketing,* 38(4), 626-642. Available at: https://doi.org/10.1002/mar.21457

Rosenbaum, M. S., Walters, G., Edwards, K. L., and Gonzalez-Arcos, C. F. (2022) Commentary: The unintended consequences of digital service technologies. *Journal of Services Marketing*, *36*(2), 97–109. Available at: https://doi.org/10.1108/JSM-03-2021-0072

Ryan, R. M., and Deci, E. L. (2001) On happiness and human potentials: A review of research on hedonic and eudaimonic well-being. *Annual Review of Psychology*, 52(1), 141–166. Available at: https://doi.org/10.1146/annurev.psych.52.1.141

Santos-Vijande, M. L., Gómez-Rico, M., Molina-Collado, A., and Davison, R. M. (2022) Building user engagement to mhealth apps from a learning perspective: Relationships among functional, emotional and social drivers of user value. *Journal of Retailing and Consumer Services*, *66*, 102956. Available at: https://doi.org/10.1016/j.jretconser.2022.102956

Schoeppe, S., Alley, S., Van Lippevelde, W., Bray, N. A., Williams, S. L., Duncan, M. J., and Vandelanotte, C. (2016) Efficacy of interventions that use apps to improve diet, physical activity and sedentary behaviour: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, 13(1), 127. Available at: https://doi.org/10.1186/s12966-016-0454-y

Sim, M., Conduit, J., and Plewa, C. (2018) Engagement within a service system: A fuzzy set analysis in a higher education setting. *Journal of Service Management*, 29(3), 422–442. Available at: https://doi.org/10.1108/JOSM-08-2016-0232

Statista. (2021) *Number of active users of Fitbit from 2012 to 2020.* Available at: https://www.statista.com/statistics/472600/fitbit-active-users/ [Accessed 27 June 2024]

Statista. (2023) *Prospective health benefits for mobile users engaging with health and fitness apps in selected countries in 2023.* Available at: https://www.statista.com/statistics/1370504/health-fitness-apps-usage-plan-reasons-selected-countries/ [Accessed 27 June 2024]

Sweeney, J. C., Danaher, T. S., and McColl-Kennedy, J. R. (2015) Customer effort in value cocreation activities: Improving quality of life and behavioral intentions of health care customers. *Journal of Service Research*, 18(3), 318–335. Available at: https://doi.org/10.1177/1094670515572128

Verduyn, P., Gugushvili, N., Massar, K., Täht, K., and Kross, E. (2020) Social comparison on social networking sites. *Current opinion in psychology*, 36, 32-37. Available at: https://doi.org/10.1016/j.copsyc.2020.04.002

Wang, Y., Neilson, L. C., and Ji, S. (2023) Mindfulness through agency in health consumption: Empirical evidence from committed dietary supplement consumers. *Journal of Consumer Affairs*, 57(2), 871-905. Available at: https://doi.org/10.1111/joca.12508

Waterman, A. S. (1993) Two conceptions of happiness: Contrasts of personal expressiveness

(eudaimonia) and hedonic enjoyment. *Journal of Personality and Social Psychology*, 64(4), 678–691. Available at: https://doi.org/10.1037/0022-3514.64.4.678

Witell, L., Holmlund, M., and Gustafsson, A. (2020) Guest editorial: a new dawn for qualitative service research. *Journal of Services Marketing*, 34(1), 1-7. Available at: https://doi.org/10.1108/JSM-11-2019-0443

Yap, S. F., Xu, Y., and Tan, L. (2021) Coping with crisis: The paradox of technology and consumer vulnerability. *International Journal of Consumer Studies*, 45(6), 1239-1257. Available at: https://doi.org/10.1111/ijcs.12724

Yousaf, A., Mishra, A., and Gupta, A. (2021) "From technology adoption to consumption": Effect of pre-adoption expectations from fitness applications on usage satisfaction, continual usage, and health satisfaction. *Journal of Retailing and Consumer Services*, 62, 102655. Available at: https://doi.org/10.1016/j.jretconser.2021.102655

Zahrai, K., Veer, E., Ballantine, P. W., de Vries, H. P., and Prayag, G. (2022) Either you control social media or social media controls you: Understanding the impact of self-control on excessive social media use from the dual-system perspective. *Journal of Consumer Affairs*, 56(2), 806-848. Available at: https://doi.org/10.1111/joca.12449

Zhou, X., Krishnan, A., and Dincelli, E. (2022) Examining user engagement and use of fitness tracking technology through the lens of technology affordances. *Behaviour & Information Technology*, 41(9), 2018–2033. Available at: https://doi.org/10.1080/0144929X.2021.191538

First-level codes	Second-order themes	Exemplar quote
- Routinized/mechanic usage - Curiosity - Link with preventive behavior performance	**Trajectory 1: Settling engagement**	"And then, in the evening, since I climb stairs, etc to go to bed, I look again [at the app], asking myself what the overall assessment of the day is. I'll check at the end of each day. Then, typically yesterday, it was a Sunday so we finished the week, I will look at what I did over the week." (Respondent 15, Female, 41)
- Acquired knowledge - Acquired routine - Decreased interest - Baseline after reaching functional goal	**Trajectory 2: Engagement curve**	"Since it has become a habit [physical activity], I don't pay much attention to the number anymore. Like, I almost always reach my objectives, because I've acquired the routine, and I haven't updated them [objectives]. Before, I used to be very into it because it was new to me, it was the first time that I could see numbers about my activities and stuff. So, it would motivate me to do more and check what I was doing. But now that it has become a habit, I think I don't pay much attention to it [smartwatch] anymore. I'm still doing sports, I still have my routine, I haven't changed it." (Respondent 30, Male, 16)
- Compulsiveness - Data dependance - Never-ending improvement cycle - Dangerous behaviors - Dejection	**Trajectory 3: Detrimental over-engagement**	"I wouldn't know how to run without my watch anymore. Like it's really a thing... it's a fairly basic watch, but I don't know, it's become... well, it's super important for me to know how... well, first, my performance, and second, it's true that... like for me, it's really, it's especially my heart rate, to see if I was really struggling, well, and it allows me to... like to... kind of balance my sensations during the run. [...] Like going for a run without a watch, even if I know it's because I'm not in shape and all, like it's impossible. I need to see my performance, it needs to be recorded, that I have a real tracking of my level." (Respondent 2, Female, 25)
- Contextual usage - Disconnection with preventive behavior - Distance with data	**Trajectory 4: Bumpy engagement**	"Yeah, I'm still quite interested in it. But again, I used to do it more before. I think this year, I started a year with a lot of activities, in-person university, parties... I have a lot less... I do a lot less sports than last year and the year before. And so, I clearly use it less. I really don't do much sport anymore. […] But when I take it up again [sports practice], for example during the summer holidays, we often go on holidays where we do cycling, etc., well then I will start using it a lot again and checking it." (Respondent 7, Male, 19)
- Problem solving - Surveillance - Performance	**Functional goal orientation**	"Let's say the WeightWatchers app. But then, I would say it was also in a different context. Because I used it when I came back from Erasmus and I had 10 kilos too many. And so, when I didn't reach my [weight loss] goals, I would think, that there is still so much to run, so many kilos to lose, so many things to do… that I won't make it. That really hit me hard if I didn't succeed. Especially at the beginning, because you expect it to happen just like that [snaps fingers], but it doesn't happen like that. And so, you're disappointed in yourself and all that. And you really have to be very persistent, I think, to reach the end. And so then, I had an even stricter view of myself, I would say, in relation to that app [WeightWatchers]." (Respondent 6, Female, 24)

- Learning - Pleasure	**Hedonic goal orientation**	"This app… First, it allows me to see the last time I did some exercise. And to visualize, to become aware of my effort... how can I say this... Strava is more for the pleasure of doing an extra physical activity. It's not part of my daily routine, it's more like the fact that I'm proud of myself, because I went cycling for this much… like I didn't realize I had done 25 kilometers, but that's great effort. Or it makes me aware of the real effort, like sometimes I feel like I'm exhausted even though I only did 12 kilometers on my mountain bike, but then I see that there was quite a bit of elevation gain.... So, it's more like that, adding a little something to a pleasurable activity." (Interview 16, Female, 40)
- High usage intensity - High data introspection - High app consideration	**High need for data**	"Because as an analyst type of guy, I always like to compare myself, to see if I'm improving compared to what I've done before, to see where I stand, if I'm meeting my weight loss goals, calorie burn goals, but also my sports goals… So, on average, I try to do 10 sport sessions per month when the weather is good, and so I also compare if I've met my minimum of 10 sessions. And then, when cycling, I always try to beat my 100-kilometer distance record. So I look at how I'm progressing, and that's it." (Respondent 14, Male, 39)
- Low usage intensity - Low data introspection - Low app consideration	**Low need for data**	"I can really see the difference [of step counts] between weekends when I stay at home and days when I go to school. When I go to school, I'm maybe at 10,000 steps, and when I stay at home, I'm maybe at 1,500. So... On school days, I see that during the day I've moved around, I've done things, I haven't just stayed in the same place all the time not doing much. [...] When I check the steps from the weekend, I just see that I haven't done much, but it's usually not a surprise because I know I did nothing all day, so I know I won't have many steps. But I don't really care, I know it's because it was the weekend, I'm not going to stress about that kind of information. It's not really something I need to know, it's just out of curiosity that I check and that's that." (Respondent 27, Male, 18)

WEB APPENDIX Coding process