Designing for Psychological Needs in Fitness Tracking: Supporting Engagement and Adherence

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ABSTRACT

Wearable fitness trackers offer new opportunities for monitoring physical activity (PA) and reduce the risk of obesity. However, much work is needed to understand how to *engage* individuals in fitness tracking and how to support *adherence* to regular PA, especially in families and in low-socioeconomic status (SES) contexts. In this work, we synthesize our qualitative findings across two fitness tracking studies with 27 families of low-SES backgrounds. We found that the psychological needs of *relatedness* and *competence* were particularly salient during fitness tracking. We provide recommendations on how to support *engagement* and *adherence* by satisfying the users' psychological needs.

INTRODUCTION

Regular physical activity (PA) is a health behavior critical for reducing the risk of obesity, a condition that can lead to chronic illness such as diabetes and cardiovascular disease [17]. Human-Computer Interaction (HCI) researchers have examined how health information technologies (e.g., self-monitoring and goal-setting tools) can support individuals to be active [6–8]. However, self-monitoring users often

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stop using their trackers or abandon their trackers altogether [3], which limits the long-term impact of these tools. Health research has shown that individuals who self-monitor can maintain long-term PA if they use the monitoring period to develop support structures that can make PA more attainable [5]. These support structures (i.e., resources for change) can be at the personal level, interpersonal level, as well as at the community and physical environmental level [16] (see Sidebar 1). Therefore, more work is needed to understand how health technologies and fitness tracking tools can help individuals to not only monitor their activity, but also develop PA support structures.

Furthermore, obesity is disproportionately impacting adults and children of low-socioeconomic status (SES) backgrounds [9]. These families face barriers at the personal, interpersonal, and community levels [16], such as beliefs and values related to exercise, stress from poverty, limited access to PA facilities, and concerns over crime [2]. Therefore, for health technologies to have an impact, more work is needed to examine how these tools can help individuals develop support structures and cope with the exercise barriers that they face, especially when promoting wellness in low-SES contexts.

In this paper, we begin to synthesize findings from our five years of in-depth qualitative work (with a total of 27 families) examining how fitness trackers can help adults and children of low-SES backgrounds to be physically active [10, 12–14]. Families are the focus of our work because obesity often develops at a young age (6-19 years of age) [9], thus promoting PA in a family setting is critical.

We contribute findings that show (1) the needs of adults and children when using digital fitness trackers, and (2) the different socio-ecological levels in which these needs emerge (i.e., personal, interpersonal, and community levels; see Sidebar 1). Furthermore, we will discuss how these needs can influence fitness tracking *engagement* and exercise *adherence*. By highlighting these relationships, we extend our prior work by providing design directions for developing interactions and design elements in health information technologies that aim to satisfy the users' needs towards long-term regular PA.

PSYCHOLOGICAL NEEDS AND SELF-TRACKING MOTIVATION

In this preliminary summation of two family fitness tracking studies (i.e., Study 1 and Study 2, see Sidebar 2 [10, 12–14]), we will first explain the needs that people have at specific socio-ecological levels. Then, we use Self-Determination Theory (SDT, see Sidebar 3) [11] to further explain the importance of these needs. In SDT, individuals' motivation in a task (e.g., using a fitness tracker and being active) can be heightened by satisfying the three psychological needs of relatedness, competence, and autonomy. Framing our findings with this theory will provide empirically-supported theoretical constructs for helping designers and researchers conceptualize design ideas. In the next section, we will use findings from our family fitness tracking studies to characterize self-tracking needs at three socio-ecological levels. We use *fitness tracker* to refer to the wearable and the companion app collectively.

Healthy behaviors are maximized when individuals are motivated to make healthful choices and their environment supports those choices [4]. The ecological model combines both individual and environmental factors of health behaviors:

Personal: factors related to individuals' beliefs, attitudes, intention, knowledge, and skills. For example: exercise enjoyment, control over exercise, self-efficacy [16].

Interpersonal: factors related to the influence of other people on an individual's behavior. For example: support from family and friends to exercise [16].

Community: factors related to the larger collective group that influence an individual's health behavior. For example: perception of safety in the neigborhood [16].

Sidebar 1: Ecological Model of Health Behavior

We conducted two studies to understand how fitness tracking tools can support families to be physically active, especially families of low-SES backgrounds [10, 12–14]. Our data encompasses accounts from 31 caregivers and 29 children from 27 families regarding their experiences using PA tracking tools. In both studies, we conducted in-depth qualitative inquiry with families living in low-SES urban metropolitan neighborhoods in the Northeast United States. These studies are:

Study 1: we evaluated Spaceship Launch, a gamified fitness tracking dashboard for families [10, 14]. Our aim was to understand how a collaborative fitness data dashboard can encourage families to collaborate together to be active. Thirteen families (15 caregivers and 14 children, 4-14 y.o.) participated in this 3-week study.

Study 2: we evaluated how families use consumer fitness tracking tools [12, 13]. The aim of this study was to understand how consumer fitness trackers are being used in a naturalistic low-SES setting. We loaned a Fitbit Alta to the caregivers and UNICEF KidPower Band to the children for 2 months. Fourteen families (16 caregivers and 15 children, 6-11 y.o.) participated in this study.

Sidebar 2: Family Fitness Tracking Studies in Low-SES Contexts

Personal-Level Needs

Findings from Study 2 (Sidebar 2) suggested that our adult participants valued fitness tracking data because it confirmed their fitness achievements [12]. For children, fitness trackers provide a feeling of achievement by increasing their awareness of when they surpassed their caregivers' fitness level [13]. In contrast, some people may not want fitness trackers to confirm their failures when they miss their goals [12]. Our findings show that our fitness tracking participants appreciated the feeling of competence, by seeking to maximize the feeling of success and subdue failures.

An immediate design direction is to celebrate users' successes as they meet their goals—for example, by sending positive messages or virtual rewards. However, praises that are not aligned with how users see their progress can provoke a negative feeling of incompetence [12]. For example, a system that tries to motivate users who almost met their goal by saying "*good job!*" can make the user feel the system is being dishonest. We will discuss the implications of our findings in the discussion section.

Interpersonal Needs

Findings from our two studies demonstrated how the need for relatedness materialized during family self-tracking. Relatedness is the need to feel connected to loved ones and to care for them [1, 11]. The importance of this need became evident as caregivers sought (1) data-driven interactions that allowed them to bond with their children, and (2) ways to help their children develop positive health attitudes while using their fitness tracking data.

First, in Study 1 (Sidebar 2), we developed a family fitness dashboard with no competitive design elements. However, many caregivers wanted some competition on the dashboard [14]. Our further inquiry revealed that some caregivers believed that competitions can spark valued family interactions. The importance of relatedness in self-tracking was further exemplified in Study 2 (Sidebar 2). We found that for some caregivers, their personal health experiences led them to be more concerned about their children's PA and encouraged them to have more in-depth fitness data conversations with their children. In contrast, caregivers who felt that their children do not need support to be active focused their attention on their children's education instead. Education was important for the caregivers in Study 2 because they believe it will offer their children a better future and living situations that are safer than what they currently have.

Community-Level Needs

Study 2 (Sidebar 2) highlighted how in low-SES neighborhoods where the crime rate is disproportionately high, families are often concerned over their families' safety. This fear of crime can inhibit families from exercising outside and using their fitness trackers. However, several families in our study reported feeling comfortable with their children playing outside, because their neighbors will look after

their children [12]. We found that families who are comfortable being active outside have conceptually mapped social spaces on top of their physical neighborhood. That is, they view their neighborhood not only in terms of its physical layout but also in terms of its social-spatial configuration. Families articulated neighborhood locales that provide some assurances for their children's safety, which helped satisfy their need to care for their children's wellbeing. Put another way, caregivers' need to care for their children is supported by having social connections with their neighbors, because those social connections provide some assurance of safety. We suggest that supporting the need for *relatedness* at the community level can support the caregivers' need to care for their children.

In summary, we discussed the psychological needs that arise during family fitness tracking. Because we did not specifically use SDT as an analytical lens when we collected our data, we did not specifically probe the SDT construct of *autonomy*. However, by identifying *relatedness* and *competence*, we suggest the importance of using SDT to examine digital self-tracking behavior. Furthermore, while SDT is focused on the individual, our data suggests that *relatedness* can emerge at the interpersonal and community levels. In the next section we will discuss the implications of these findings.

DISCUSSION

Prior research has used the the notion of *wear-time* and *adherence* to describe the outcomes of fitness tracking [15]. In this work, we expand the notion of wear-time by using the term *engagement*. *Engagement* describes how interested a person to use the fitness tracker wearable and the companion app (i.e., not just how often they used the trackers), irrespective of whether the recommended fitness goals were met. *Adherence* to health recommendations, on the other hand, describes whether fitness tracking users achieve the recommended health behavior [15]. We use findings from our studies to highlight how to support (1) fitness tracker *engagement* as well as (2) *adherence* to exercise recommendations.

These two outcomes need to be demarcated because they are two parallel but interdependent goals. Designing only for supporting *engagement* (e.g., using gamification) may not support long-lasting *adherence* to exercise recommendations, especially if the novelty of the design wears off. But this is not to suggest that supporting engagement is a futile attempt. If a fitness tracker is not engaging to use, the users may not be exposed to the attitudinal and behavioral change opportunities that the fitness tracker offers—thus limiting the impact to *adherence* to exercise recommendations. While the need to support *engagement* and *adherence* has been emphasized in prior health system studies, in this work we provide empirical evidence on how psychological needs impact *engagement* and *adherence*.

Support at the Personal Level. Given the importance of the feeling of *competence*, we highlight the need to unpack the differences between the feeling of being competent in meeting the goals articulated in the fitness trackers, and the feeling of being competent in engaging in PA. A user who

Sidebar 3: Self-Determination Theory (SDT)

Self-Determination Theory (SDT) describes people's motivation to perform a task [11]. A person can be internally motivated (i.e., they do the task because it is intrinsically satisfying) or externally motivated (e.g., they do the task because they believe it is important or they are concerned about the negative consequences of not performing the task).

SDT posits that individuals are more motivated to perform a task if their psychological needs are satisfied. These needs are:

Relatedness: the need to feel connected to others and care about them [1].

Competence: the need to be able to complete the task successfully.

Autonomy: the feeling of freedom to perform the task.

feels competent in completing the goals within a fitness tracker may feel motivated to continue using the tracker (thus impacting *engagement*), but they may not feel confident in their ability to be physically active (thus limiting *adherence*).

Therefore, fitness trackers should help users to notice their increased capacity to be active, not just highlighting their ability to meet their in-app goals. Caregivers in Study 2 often discussed the bodily experiences of becoming more fit while self-tracking [12]. We suggest that fitness trackings should help users notice the bodily experiences that arise when they become progressively more fit. The aim is helping users separate the in-app experiences from the in-body experiences, the latter of which is more closely linked to the user's feeling of *competence* to *adhere* to their fitness goals.

Support at the Interpersonal Level. At the interpersonal level, we discussed the importance of *relatedness* during caregiver-children interaction during fitness tracking. We suggest that fitness tracking *engagement* can be supported by incorporating features that spark caregiver-child interaction and thus satisfying the need for *relatedness*. However, we argue that supporting this form is *relatedness* is not enough to support *adherence* to exercise recommendations. For example, if a family finds a new activity that is equally fun but less physically strenuous, the family may abandon the healthy activity and switch to the new activity. Therefore, while families are still *engaged* in self-tracking, systems should help them develop PA support structures that can facilitate long-term *adherence* to exercise recommendations.

Findings from Study 2 point to a design direction for helping users develop such PA support structures. We found that caregivers' need to care for their children led them to show the causal meanings of their fitness data, thus supporting positive attitudes towards PA [13]. These findings show how the alignment between caregivers' needs and the fitness trackers features led caregivers to help their children make sense of their data on their own volition. We further support that to encourage fitness data sensemaking, fitness trackers should be aligned with users' broader life goals. Our data sheds life these goals in caregiver's context, namely supporting their children safety, health, and education as well as to care for each other as a family.

Support at the Community Level. Study 2 findings pointed to the importance community support in providing an assurance of safety and thus enabling the caregivers and their children to use their fitness trackers in their neighborhood. In other words, caregivers' need for *relatedness* at the interpersonal level (i.e., with their children) can be satisfied by having *relatedness* at the community level (i.e., neighbors that provide the assurance of safety). Therefore, we suggest that fitness trackers should provide features that help communities to grow and nurture supportive social spaces—thus enable families to exercise in their neighborhood and increase their *adherence* to exercise recommendations.

CONCLUSION

Findings from our two family fitness tracking studies in low-SES context suggest two salient psychological needs during family fitness tracking: achieving feelings of *relatedness* and *competence*. We encourage future work to further examine how health systems can support *engagement* and *adherence* by satisfying the psychological needs of relatedness and competence within families, as well as examine the influence of *autonomy* in family fitness tracking.

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